INFLATION, MONEY SUPPLY AND THE EQUITY RISK PREMIUM; A RESPECIFICATION

by

David Gordon Gowing

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Abstract

A Re-Specification of the Equity Risk Premium

This thesis establishes the impact of inflation on the equity risk premium in North America by empirical modeling of time series data (econometric models). The equity risk premium is a monetary value that people require in order to change their investment behavior, in particular to switch investment funds from risk free vehicles to risky equity securities. The specific macroeconomic variable of interest is inflation.

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Table of Contents

INTRODUCTION

The consumption model used by Mehra & Prescott (M&P 1985) is a model based on human behavior; the discipline of finance is the study of human behavior[1]. The true value of any asset is its perceived value, what people are willing to pay in order to buy the asset. If there are no buyers, there is no monetary value.

We use money to barter the exchange of goods and services, both necessities and luxury items. It is the consumption of these goods and services today versus tomorrow, which is the study of human behavior that brings us to the equity risk premium.

The equity risk premium is a monetary value that people require in order to change their behavior; specifically to switch investment funds from risk free vehicles to equity securities. It is the perceived value of the premium that counts, not the actual theoretical value. I believe and it is the purpose of this paper to substantiate, the equity risk premium utilized by the North American (N.A.) investor, includes the macro-economic factor of inflation (Friend, Landskroner, Losq; 1976)

The father of Arbitrage Pricing Theory (APT), Stephen Ross in his investment company Ross and Ross, presently (2000) utilize five factors (factor risk premium) that are sources of systematic risk. Forty percent of the aggregate factor risk premium is inflation; another forty percent is directly correlated to inflation. Inflation is a factor in the final twenty percent of the aggregate factor risk premium.

In the paper 'Stochastic Inflation and the Equity Premium' (Labadie, Pamela; J. of Monetary Economics, 1989), the author states 'Inflation affects the equity premium via the inflation tax and the inflation risk premium. The equity premium in the monetary

[1] The idea for this thesis was realized during the participation and completion of financial economics MSCA 601 seminar requirements, taught by Dr. Sandra Betton.

model and the real model, a continuous state-space generalization of Mehra and Prescott (1985), is sensitive to the endowment growth's conditional covariance. When the standard deviation is increased from 3.49% to 5.59%, the real model produces an equity premium of 2.8% in the relevant range of risk aversion parameters. The monetary model results in an equity premium of 5.81%, if the conditional covariances of inflation and endowment are increased. Most of inflation's impact on the equity premium results from the inflation tax assessment.'

My own intuition on inflation being a macro-economic factor in the equity risk premium came from empirical knowledge in the financial industry. In the early 1980's when inflation jumped up and there were guaranteed investment certificates[2] offered at 19% per year, for a sixty-month term, many investors locked in for five years. Sure equities might have given greater than 19% per year over five years, but independence from the system was a strong persuasive factor. The investors consider he / she can live on 19 % return on their capital annually and they do not have to concern themselves for five years. They have independence from systematic risk and peace of mind. There is and was a feeling of fear and uncertainty caused by unusually high rates of inflation; resulting in a perceived increase in systematic risk.

In the methodology section on the econometric modeling, the author's suggestion on the times series data, came from interpolation of empirical results. When you have five predictor variables and the plots of actual versus fitted results (both serpentine) over a forty year period, are so close you need colored lines to differentiate between them; it is difficult to consider there may be inaccuracy in the point estimators. This lead me to

[2] GIC's offered by chartered banks in Canada, which were government insured up to $60,000. per account (CDIC insured)

suggest that the serial correlation of residuals in time series data is caused by the drift and if the response variable and predictor variables are co-integrated (i.e. they drift together), then the independence of error terms is violated by the drift only and the point estimators are accurate. These findings are supported by the GARCH modeling results. GARCH is a distributed lag model with geometrically declining weighted model of past volatilities and variance.

The remainder of the report is as follows:

Part I: Theoretical Development and Literature Review

Part II: Methodology (econometrics)

Part III: Interpretation and Results

Part IV: Conclusions and Recommendations

Part I: Theoretical Development and Literature Review

To interpret the subject of the 'equity risk premium' one has to begin with the discussion of investor's utility functions, risk aversion, markets under uncertainty and asset pricing theory. In the paper 'The Demand for Risky Assets' Irwin Friend and Marshall Blume (Dec. 1975) remark on the 'paucity of empirical work on the determinants of the market price of risk[3] in contrast to the abundance of work on the interrelationships of risk premiums among different risky assets.' Irwin and Blume point out that the relationship between the utility functions and wealth of the investors is required to construct an aggregate demand function for risky assets; however there are many other uses, such as the derivation of household consumption and savings functions. Other assessments needed include the impact of government fiscal and monetary control on economic welfare and the problems in extending single period decisions to a multi-period world.

The proper modeling of human behavior it seems would have to utilize the 'family unit' as the models 'unit of industry'. The building block of most every thing we know or have in today's society, is the 'family unit'.

Interestingly Friend and Blume mention as the first limitation of their empirical model, 'the model made no adjustment for inflation. The presence of unanticipated inflation would mean that no asset denominated in nominal dollars could be considered risk free.'

[3] The market price of risk is the difference between the expected rates of return on the market portfolio of risky assets as a whole and on a risk-free asset per unit of risk of the market portfolio. Friend and Blume found that the relevant measure of risk is the variance of returns.

Present financial theory states that the ERP is compensation for accepting exposure to non-diversifiable systematic risk.

> The more volatile the rate of general inflation, the harder it becomes to extract the signal about relative prices from the absolute prices. ... The growing volatility of inflation and the growing departure of relative prices from the values that market forces alone would set combine to render the economic system less efficient, to introduce friction in all markets, and, very likely, to raise the recorded rate of unemployment (Friedman, 1977).

Here Friedman (Nobel Laureate in economics) warns of the macro economic factor inflation and the impact it and its' volatility have on systematic risk.

Therefore if the ERP is compensatory for exposure to systematic risk, it must include the macro-economic factor inflation in its theoretical definition.

Most of presently accepted financial theory is based on no arbitrage risk neutral pricing assumptions. The replicating portfolio methodology guarantees no arbitrage and therefore all assets are priced by a risk neutral distribution. All assets will have different levels of risk (as measured by their standard deviation of returns) but they all have the same expected return according to the risk neutral distribution.

Many argue that in the absence of arbitrage, the equilibrium market price of any asset will equal its fundamental value, defined as the appropriately discounted present value of the asset's future dividends. The Fundamental Theorem of Asset Pricing states that in the absence of arbitrage, there is an existence of a probability measure under which every asset's discounted price is a martingale and there exists an optimum for a hypothetical agent who prefers more to less (Loewenstein & Willard 2000). A martingale is a zero drift stochastic[4] process, which has the convenient property that its expected value at any future time is equal to its value today.

By the separating hyper-plane theorem, there is no arbitrage if and only if, there exists a risk neutral distribution (RND) such that the time zero price of every asset is equal to the expected value at time 1 payoff, discounted at the risk-free rate. Under the risk neutral distribution all assets have the same expected return, which is the risk free rate. One reason an ERP and risk neutral pricing and no arbitrage assumptions are not contraindicative; is that all investors are consumers as well, and they have consumption / savings decisions to make with respect to consumption today versus consumption tomorrow. As inflation is a tax on the nominal value of the investors' purchasing power, inflation has to be involved in the decision making process of a rational investor / consumer and therefore effects the ERP of the North American investor.

'The absence of arbitrage implies that an expected excess return or risk premium will only be paid for bearing non diversifiable systematic risks' (Nabil Al-Najjar 1997).

In the paper 'The Demand for Risky Assets under Uncertain Inflation' (Friend, Landskroner, Losq 1976) the author's state:

> Regardless of their wealth, the coefficients of proportional risk aversion for households are on average well in excess of one and probably in excess of two, so that households are more risk averse than would be implied by a log utility function.
>
> (1) The traditional capital asset pricing model measured in nominal terms (CAPM)

[4] A stochastic variable's future value is uncertain and a stochastic process is an equation describing the probabilistic behavior of a stochastic variable.

understates the MPR[5] (market price of risk) if an uncertain inflation is expected and if there is a positive covariance between the rate of return on the market and the rate of inflation. (The reverse is true if an uncertain deflation is expected or if there is a negative covariance between the market return and the rate of inflation.) (2) The CAPM overstates the risk of an asset under expectations of uncertain inflation if there is a positive covariance between the rate of return on the asset and the rate of inflation. ... Thus, in the presence of inflation the usual beta measure may be an understatement of risk for low beta assets and overstatement of risk for other assets, helping to explain at least part of the observed non-linearity in the relationship between return and non-diversifiable risk.

Here we see a direct correlation between inflation and the MPR (ERP) as the authors develop a modified CAPM model.

A. A Brief Overview of the Banking Systems in North America:

The equity risk premium[6] (ERP) is significantly lower in Canada (3.8% January 1970 to April 1999) than in the USA (7.5% January 1970 to April 1999). This financial data seems to indicate that Americans are significantly more risk averse than Canadians, as they demand a greater ERP[7] in order to invest in risky assets. The difference between the US ERP and the Canadian ERP is what is referred to as the equity risk premium puzzle: specifically why is the USA ERP so high?

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[5] The market price of risk is the difference between the expected rates of return on the market portfolio of risky assets as a whole and on a risk-free asset per unit of risk of the market portfolio. Friend and Blume found that the relevant measure of risk is the variance of returns.

[6] This is the equity risk premium (ERP) definition used by Mehra and Prescott (1985) and is based on the risk averse log utility function. ERP = equity's return – risk free return.

[7] The ERP is unconditional in that it is a demand side model. The definition is the above M&P (1985)

Possible reasons for this apparent disparity between USA and Canadian investors, is found in the differences in the respective banking systems.

For years a significant proportion of the Canadian equity market's investment capital came from the financial intermediary industry. This large industry was dominated by a few large chartered banks[8], which could easily diversify away nonsystematic risk and was therefore willing to accept a lower ERP. The financial intermediary industry in the USA however, proportionately accounts for a smaller part of the total investment capital; due to state banking system, which allowed for only one or two branch offices per bank. This resulted in more direct investment into the equity market by individuals, who lack the size and ability to diversify nonsystematic risk efficiently. The aggregate US investor therefore demanded a greater ERP, as on average he / she was on a per capita basis, significantly smaller (Gowing 2000). The USA banks were also on a per capita basis, smaller than the Canadian chartered banks.

The above explanation for the different ERP's (USA versus Canada) indicates that in North America, the ERP is at least partially affected by diversifiable nonsystematic risk and not only non-diversifiable systematic risk. This is counter intuitive with respect to accepted financial theory today, based on no arbitrage risk neutral pricing. The absence of arbitrage implies that an expected excess return or risk premium will only be paid for bearing non-diversifiable systematic risks (Nabil Al-Najjar 1997). In the USA we see that the investor demands a larger ERP to compensate for both systematic risk and a greater degree of nonsystematic risk and this is largely systemic of the USA banking system.

The individual Canadian investor is and was more risk averse than their USA counterpart. In the early 1980's; 40% of US families had mutual fund investments, where

[8] Chartered banks in Canada have thousands of branches across the country.

less than 10% of Canadian families had mutual fund investments. Similar ratios were evident with ownership of stocks, where the individual Americans where much quicker to invest in the equity markets and in larger numbers. Proportionately more Canadians put their savings into guaranteed investments offered by the financial intermediary industry, then their USA counterparts. Logically this suggests the Canadian investor is more risk averse than their USA counterpart and not vise versa, as indicated by the difference in ERP's.

B. Tax Implications:

Equity[9] investments in N.A. are tax preferred. The capital gain accrues tax-free until the capital gain is realized (crystallized) and then only a portion[10] of the capital gain is taxable as income. Income from bonds and T-bills (any income) is taxed fully in the year it is received. The tax preferred treatment in equity investments is a factor in the N.A. investor when deciding their individual ERP, as well as on the aggregate ERP. The tax-preferred treatment on equities over income vehicles has somewhat lessened with the lowering of personal income taxes. This may be the driving force behind the government's reduction in the portion of capital gains that is taxable. Further research in effects of taxation levels on the equity risk premium (ERP) would be useful. Taxation is a direct factor in open investments, as it is the after tax gains that is important. Taxation is an indirect factor in tax-deferred vehicles (retirement vehicles), the income is fully taxed when the investor retires and draws income from these vehicles.

[9] Equity investments in open investment vehicles, not tax deferred registered vehicles where all investments receive the same tax treatment.

[10] In Canada presently the portion of capital gain that is taxable is 67%, recently down from 75%. At the same time the dividend tax credit on Canadian dividends was not changed. This makes Capital gains tax preferred over dividends (taxed each year they are received) and may increase share repurchases by corporations (and reduce the already shrinking dividend market) as a means of transferring wealth to the shareholder.

Part II: Methodology

A. Model Theory and Methodology:

The equity risk premium (ERP) is a monetary value that investors require in order to change their behavior; specifically to switch investment funds (savings) from risk-free vehicles to equity securities (risky assets). It is the perceived value of the ERP that matters, as the perceived value will affect the investors behavior.

The methods of analysis of empirical data vary but the goal is the same. In this thesis, econometric analysis of financial time series data from 1959 / 01 to 1999 / 01, are of events both prior to and subsequent to the publication of theory[11] by Mehra and Prescott (1985).

My modeling is an inductive analytic model, in that I am trying to falsify a certain set of hypothesis about the presently accepted theoretical definition of the equity risk premium, using empirical[12] evidence. In particular my hypothesis is: the current theoretical definition of the ERP model is mispecified, because of the missing macro-economic variable, inflation. Hence the appropriate evidence and method of analysis is econometric modeling.

The thrust of the model building was to proxy the relationship of the macro-economic factor inflation with the equity risk premium (ERP). Such a proxy is not at first obvious. The current theoretical definition of ERP based on the aggregate risk averse investor, has the inflation factors cancel out; leaving the defined theoretical ERP equaling the return of the market (r_m) minus the return of the risk free asset (r_f). The aggregate risk

[11] Theoretical definition of ERP… see equation # 1 below
[12] Empirical evidence is real data. A theory that is derived from empirical evidence is a positive theory. Positive theory is a form of inductive analytic knowledge.

averse investor would in the aggregate have a logarithmic utility function. It is the maximization of the logarithmic utility function that results in the current theoretical definition of ERP excluding inflation as a factor.

$$ERP = (R_{mkt} - infl.) - (R_f - infl.)$$

$$ERP = R_{mkt} - R_f \qquad \text{...............} \quad 1.$$

Where: R_{mkt} = return of the market, annual average rate

R_f = return of the risk free asset, annual average rate

infl. = rate of inflation (annualized average rate)

Present financial theory states that the ERP is compensation for accepting exposure to non-diversifiable systematic risk. Systematic risk is affected by monetary policy of the governments, as they tighten or expand the money supply predominantly to control inflation.

In their 1975 paper 'Demand for Risky Assets', Irwin Friend and Marshall E. Blume ('The American Economic Review vol 65, issue 5, Dec. 1975) concluded. 'First, regardless of their wealth level, the coefficients of proportional risk aversion for households are on average well in excess of one and probably in excess of two. Thus, investors require a substantially larger premium to hold equities or other risky assets than they would if their attitudes toward risk were described by logarithmic utility functions.' Interestingly Friend and Blume mention as the first limitation of their empirical model, 'the model made no adjustment for inflation. The presence of unanticipated inflation would mean that no asset denominated in nominal dollars could be considered risk free.'

My econometric models are based on the premise that if M1 and M2 are positively correlated to the rate of inflation and M3 is negatively correlated to rate of inflation, then a theoretical definition of ERP that incorporates the macro-economic factor inflation would be both sufficient and necessary. First we must clearly define M1, M2 and M3. The following definitions are quoted from the Federal Reserve Release (H.6);

'M1, M2 and M3 are progressively more inclusive measures of money: M1 is included in M2, which is included in M3.

- M1, the most narrowly defined measure, consists of the most liquid forms of money, namely currency and checkable deposits.
- The non-M1 components of M2 are primarily household holdings of savings deposits, time deposits, and retail money market mutual funds.
- The non-M2 components of M3 consist of institutional money funds and certain managed liabilities of depositories, namely large time deposits, repurchase agreements, and Eurodollars.'

Monthly data are available back to January 1959.

Consistent with this specification of the new model of the equity risk premium that includes inflation based on U.S. definitions, the database comprises U.S. data.

Here lies the basis of the models: when the rate of inflation goes up, individual investors cash out of their risky assets and place their savings into guaranteed vehicles as defined by M1 and M2. Therefore as inflation goes up, M1 and M2 also go up, as they are positively correlated to the rate of inflation. As these individual investors cash out of their risky assets, they redeem their risky assets from the financial intermediary industry[13]. It is the net redemptions during periods of increase, in the rate of inflation that result in the M3 measure of money supply, going down. The financial intermediary

[13] The financial intermediary industry sold the risky assets to the investors and therefore has to meet the net redemptions as these investors sell their risky assets for cash.

industry has to draw down its large institutional money funds (the non-M2 components of M3) to meet the net redemptions. Even though the M2 component of the M3 measure goes up with inflation, the aggregate M3 measure goes down.

The response variables M1, M2 and M3 for the three econometric models are calibrated in 'price levels' not 'percent change from previous period'. The reason is the efficient market hypothesis (EMH); in an efficient capital market, prices fully and instantaneously reflect all available information. There is information in the levels of the money supply that would be lost if I used percent change from the previous period. This was verified by running the OLS[14] models with the response variables calibrated in percent change re previous period.

The money supply measures are best described as a Markov stochastic process, where only the current value of a variable is relevant for predicting the future. In the above example if the level over 'n' periods varied + or – ten percent, then using an econometrics model where the money supply response variable was calibrated in percent change from the previous period, would be at best only ten percent accurate with respect to the OLS models with the proper response variable (money supply) calibration of 'price level'. There is information in the level or value of the variable, which is relevant for predicting the future. This is intuitive with respect to the EMH. This is also empirically supported in econometric modeling of time series data, where response variables calibrated in percent change, seldom show significant results. My models with response variables calibrated in price levels show significant results and the OLS

[14] OLS; ordinary least squares

modeling is confirmed by the distributed time lag for variance GARCH[15] models. With the GARCH modeling, concern over serial correlation and heteroskedasticity of residuals is eliminated.

However concern over serial correlation of the fitted values is not eliminated by GARCH modeling, but is handled with the time lag models (both OLS and GARCH). The serial correlation of both the residuals and fitted values may be resultant of the non-stationary unit roots (non trend reverting drift).

In GARCH modeling the variance of the error term (residual) has three components; a constant, last period's volatility (the ARCH term) and last period's variance (the GARCH term). (Pindyck, & Rubinfeld "Economic Models and Economic Forecasts" (1998)) An ARCH order of 1 means the model of the variance involves only the most recent actual squared value. A GARCH order of 1 means that the model of the variance is first order autoregressive, if a shock causes the variance to rise, the effect dies out over time geometrically. (E-Views Student Version)

My models use predictor variables to show changes or shocks in systematic risk and therefore the appropriate calibration for a stock index as a predictor variable in these models, is percent change from the previous period (systematic shock).

The paper 'Money Demand: The effects of Inflation and Alternative Adjustment Mechanism' (Stephen M. Goldfeld & Daniel E. Sichel; in The Review of Economics and Statistics, vol. 69, issue 3, Aug. 1987), concludes; 'empirical results for the partial adjustment mechanism (PAM) did indicate that inflation played a significantly negative

[15] GARCH models; the variance today depends on all past volatilities, but with geometrically declining weights. The geometrically declining weights all but guarantee serial correlation and heteroscedasticity of error terms by definition of the GARCH models design. However the serial correlation of the fitted values is no taken care of by the GARCH modeling alone.

role in the demand for money. We then noted the a priori restrictiveness of the PAM specification and also uncovered some problems with serial correlation and homogeneity. Estimation of a distributed lag model provided a more general way for testing homogeneity and for examining the role of inflation on money demand. Unlike the PAM specification, this more general model passed the homogeneity test at the same time that it confirmed the role for inflation'.

When people cash out of the risky equity assets and put their money into M1 and M2 type guaranteed investments, the demand for money goes down; as per above findings 'inflation played a significantly negative role in the demand for money' and as per my proposed econometric model, the investors no longer require money to buy risky assets. That is the demand for M3 goes down it transfers into M1 and M2.

In the event that M1 and M2 were positively correlated to rate of inflation and M3 was negatively correlated to the same, then I offer a more accurate definition of the actual or positive ERP for the North American investor as follows;

$$ERP = R_{mkt} - R_f \text{ - rate of inflation} \qquad \ldots\ldots\ldots\ldots\ldots \; 2.$$

Where; R_{mkt} = return of the market, annual average rate

R_f = return of the risk free asset, annual average rate

Rate of inflation is annual average rate for the specific time horizon.

The above definition for the ERP is for both single period and multi-period time horizons and is a demand side model, as this is what the North American investors demand for holding risky assets. The above definition for the return of the market and the return of the risk free asset can both be defined as real returns. In the latter case, the inflation factors cancel each other out in the first two terms as they did in equation #1.

Authors Kandel, Ofer & Sarig in the JOF paper[16] "Real Interest Rates and Inflation: An Ex-Ante Analysis" conclude:

We find a negative correlation between ex-ante real interest rates and expected inflation. This contradicts the Fisher hypothesis[17]. It is consistent under diminishing returns to capital, with Mundell-Tobin argument that high inflation expectations cause higher capital accumulation. It is also consistent with the Darby-Feldstein argument that taxation of inflation gains causes the real rate of interest to be negatively correlated with expected inflation and with Stulz's argument that uncertainty about monetary policy leads to such a negative correlation. We also find that nominal interest rates include an inflation premium.

The higher accumulation of capital correlated with high inflation expectations, is indicative of M1 and M2 being positively correlated to inflation as per basis of my econometrics model.

If nominal interest rates include an inflation premium, then it is only logical that the theoretical definition of the ERP would also include the macro-economic factor inflation in its definition. Pamela Labadie found in her paper 'Stochastic Inflation and the Equity Risk Premium (Journal of Monetary Economics Sept 1989); inflation affects the equity risk premium via the inflation tax and the inflation risk premium.'

Interpretation of time series data is ex-post by definition. By the time you examine the data and complete the econometric modeling, you are ex-post. The results can be used

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[16] JOF: Journal of Finance; volume 51, issue 1 March 1996.

[17] Fisher hypothesis; that the real rate of interest is independent of inflation expectations.

to forecast or replace previous theory through falsification of the same. The theoretical definition of the ERP as used by Mehra and Prescott is positivistic knowledge and is contingent on empirical evidence from actual future events (data) for falsification or failure thereof (inductive evidence).

If my modeling is correct, than I can offer equation # 2 as a positive theoretical definition for the ERP (empirical evidence) as perceived by the North American investor.

This positive theory (equation #2) would then become inductive analytical knowledge.

B. Data Procurement:

All series data was unsmoothed and not seasonally adjusted. The Canadian data was limited in most cases to 1970 forward. The US data and all data used in the final econometric modeling were from 1959 / 01 to 1999 / 01 (monthly, end of period).

Canadian data for the M1, M2 and M3 measures of money supplies, for Canadian inflation rates and data for international bond yields (US-long-term government bond yield (over 10 yrs)) was obtained from Cansim I and Cansim II Series @ CHASS. The average of five Cansim II series for Canadian inflation rates was used in the modeling (http://dc2.chass.utoronto.ca/cansim2/index.jsp).

The US inflation rates were obtained from the Ibbotson database. Series (IBOR001103). (http://www.valuation.ibbotson.com).

The US money base, M1, M2, M3, debt levels, non-federal to federal debt ratios, prime bank rate and federal reserve rates, were obtained from the Federal Reserve Statistical Release (http:www.federalreserve.gov/releases).

The stock indices percent returns per end of period (monthly) were determined using index price level data from yahoo.com. (http://finance.yahoo.com). Specifically returns for the Standards & Poor's (S&P) 500 index (value weighted index), Dow Jones Industrial index (price weighted index) and the TSE 300 (modified[18] value weighted index).

C. Econometrics, Model Building:

The econometric model building began with Canadian data and the three response variables M1, M2 and M3. My suspicion was verified, that the money supply measures M1, M2 and M3 were overwhelmed by the US money base data. Simple linear regressions (SLR) of the three Canadian money supply measures as response variables against the US money base as the predictor variable; showed R^2 values greater than 0.91, for the three SLR models.

I then started working on US data as the US money base overwhelmed the Canadian money supply measures. Whenever there was a correlation of > 0.69 between two predictor variables, I ran a SLR of one against the other and used the residuals of the former as the replacement predictor variable in the original multiple linear regression (MLR) model. These predictor variable names always begin with 'RES', such as RESIDDOW. This predictor variable is the residuals obtained from the SLR of the

[18] The modified value weighted TSE 300 index; the number of shares in all control blocks (> 20% of outstanding shares) is subtracted from the number shares outstanding to determine an adjusted market value. TSE 300 data obtained form yahoo.com prior to the change of name and ticker for the TSE 300, now being the S&P TSX Composite with ticker 'GSPTSE'.

percent returns of the DOW index (response variable) against the percent returns of the S&P 500 index (predictor variable).

Unless otherwise stated all econometric modeling was done using E-Views econometrics package from the University of Chicago. All unit root testing was completed using both the Augmented Dickey-Fuller Unit Root Test and Phillips-Perron methods and all cointegration testing was completed using the Johansen Cointegration test procedure. For all three models (M1, M2 & M3), the only variable that was non-stationary (unit root) for all 6 types of unit root test conditions[19] was DEBTNF_F[20] predictor variable in the M3 models. Test results on this variable were not far from rejecting the null hypothesis of a 'unit root' at the 10% level of significance. .....See Appendix 1.

The theory indicates that with non-stationary variables (unit roots with a non mean reverting drift), as long the non-stationary predictor variables and the response variable drift together, they are cointegrated and OLS (ordinary least squares) linear regression is accurate. In other words, the two variables follow random walks but there exists a linear combination of those variables that is stationary. (Pindyck, & Rubinfeld 'Economic Models and Economic Forecasts 4th edition 1998). The efficacy of the above co-integration theory is supported by the plots of the fitted versus actual values for the response variable, in this case USM3

A Johansen Co-integration test was run on the DEBTNF_F predictor variable and the response variable M3; seven co-integration relationships (at the 5 % level of significance) were positive. This supports OLS econometric modeling. All predictor

[19] Unit root test conditions for both the augmented Dickey-Fuller Test and the Phillips-Perron Test were; without trend nor intercept, with intercept only and with both a trend and an intercept.
[20] DEBTNF_F is the ratio of non federal debt to federal debt (USA).

variables were run against their respective response variables in the Johansen Co-integration test.

Serial correlation test was the Breusch-Godfrey Serial Correlation LM Testing for non-homogeneity of error terms was done using the White[21] Heteroskedasticity Test. These test were completed on the original OLS models without any lagged predictor variables.

In support of the above, the plots of the fitted versus the actual values of the response variable M1 in the OLS model were so close, that from 1959 through to 1987, it is hard to differentiate the two lines. The GARCH modeling eliminated any concerns about serial correlation of the residuals, as the GARCH model is a distributed time lag model with geometrically weighted declining terms for past volatilities and variance. Serial correlation of the residuals is expected in a GARCH time lag model. The GARCH modeling specifically eliminates any concerns about heteroskedasticity as it is designed for the same. With geometrically declining weights for the past volatilities and variances, there has to be heteroskedasticity of error terms. In all three models (M1, M2, M3) the GARCH models supported the OLS models extremely well with respect to inflation.

The econometrics for the original OLS and GARCH models for the USA M1, M2 and M3 measures (no time lagged predictor variables) are listed in Appendix 2. These models had serial correlation of the residuals (poor Durbin-Watson statistics).

However serial correlation of the fitted values was handled by using time lag models (OLS and GARCH) and with these models the Durbin-Watson (D-W) values are extremely close to 2.00. These models support my demand side model for the ERP as

[21] The White heteroscedasticity test was used as in is not dependent on normality of residuals.

both M1 and M2 are positively correlated to inflation and M3 is negatively correlated to inflation. It is these models that are in the pure academic sense acceptable, as they account for or correct for serial correlation of both the residuals and the fitted values, as well as the heteroskedasticity of the same residuals (error terms). Interestingly the graphs (M1, M2, & M3) of the actual versus the fitted results are so close over the entire forty-year period; the graph appears to show only one serpentine line, for both the OLS and GARCH models.

This is positive inductive evidence in support of my hypothesis, that M1 and M2 are affected positively by inflation whereas M3 is affected negatively.

D. Final Models for US M1, M2, and M3:

M1: Econometric Model (OLS)

Dependent Variable: USM1
Method: Least Squares
Date: 09/05/02 Time: 16:03
Sample(adjusted): 1959:06 1999:01
Included observations: 476 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	0.000744	0.000597	1.246648	0.2132
RES_RBK_IBY	-1.244614	0.271881	-4.577784	0.0000
INFLUS(-3)	266.1550	91.51932	2.908184	0.0038
RESIDTSE	-11.73311	18.19764	-0.644760	0.5194
C	1.850940	1.103171	1.677836	0.0940
USM1(-1)	0.966643	0.045487	21.25116	0.0000
USM1(-2)	-0.332175	0.059729	-5.561360	0.0000
USM1(-3)	0.517732	0.059831	8.653194	0.0000
USM1(-4)	-0.160443	0.046303	-3.465066	0.0006

R-squared	0.999472	Mean dependent var	498.0378
Adjusted R-squared	0.999463	S.D. dependent var	342.8301
S.E. of regression	7.947531	Akaike info criterion	7.002326
Sum squared resid	29497.24	Schwarz criterion	7.081084
Log likelihood	-1657.554	F-statistic	110425.1
Durbin-Watson stat	1.999951	Prob(F-statistic)	0.000000

Where:

USM1 is the US M1 money supply measured in Billions of US dollars.

USDEBT is US government debt total (both State and Federal) in billions US dollars.

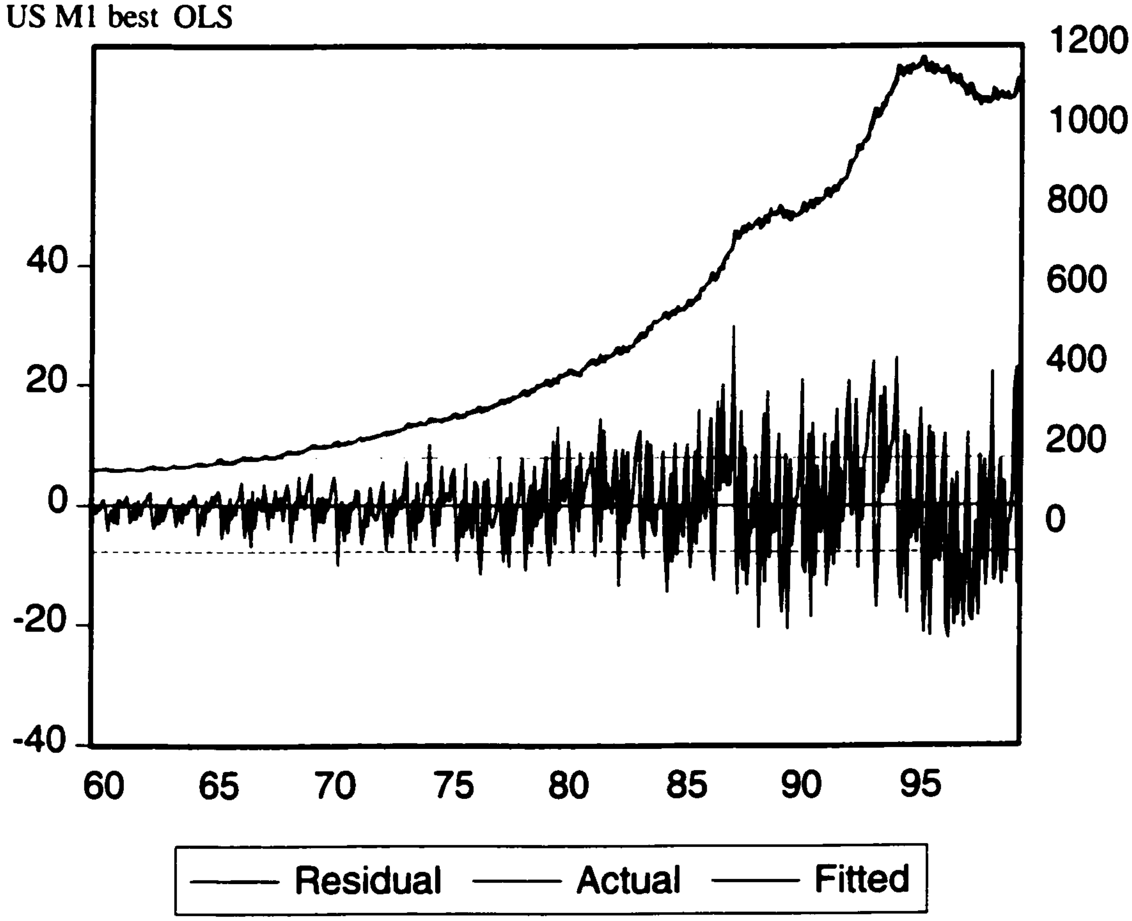
RES_RBK_IBY is the residuals from the SLR of the bank rate against the international bond yields.

INFLUS(-3) is the three month lagged value of the US rate of inflation in fractional numbers (i.e. 1% = 0.01)

RESIDTSE is the residuals from the SLR of the % returns of the TSE 300 index against the % returns of the S&P 500 index.

Here we see that USM1 directly (positively) correlated to US inflation. If the US rate of inflation goes up 1%, then three months later the US M1 money supply goes up 2.67 billion dollars. There is no serial correlation as the D-W statistic is 2.0000.

US M1 best OLS



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M1 are almost identical, over the forty-year period.

US M1

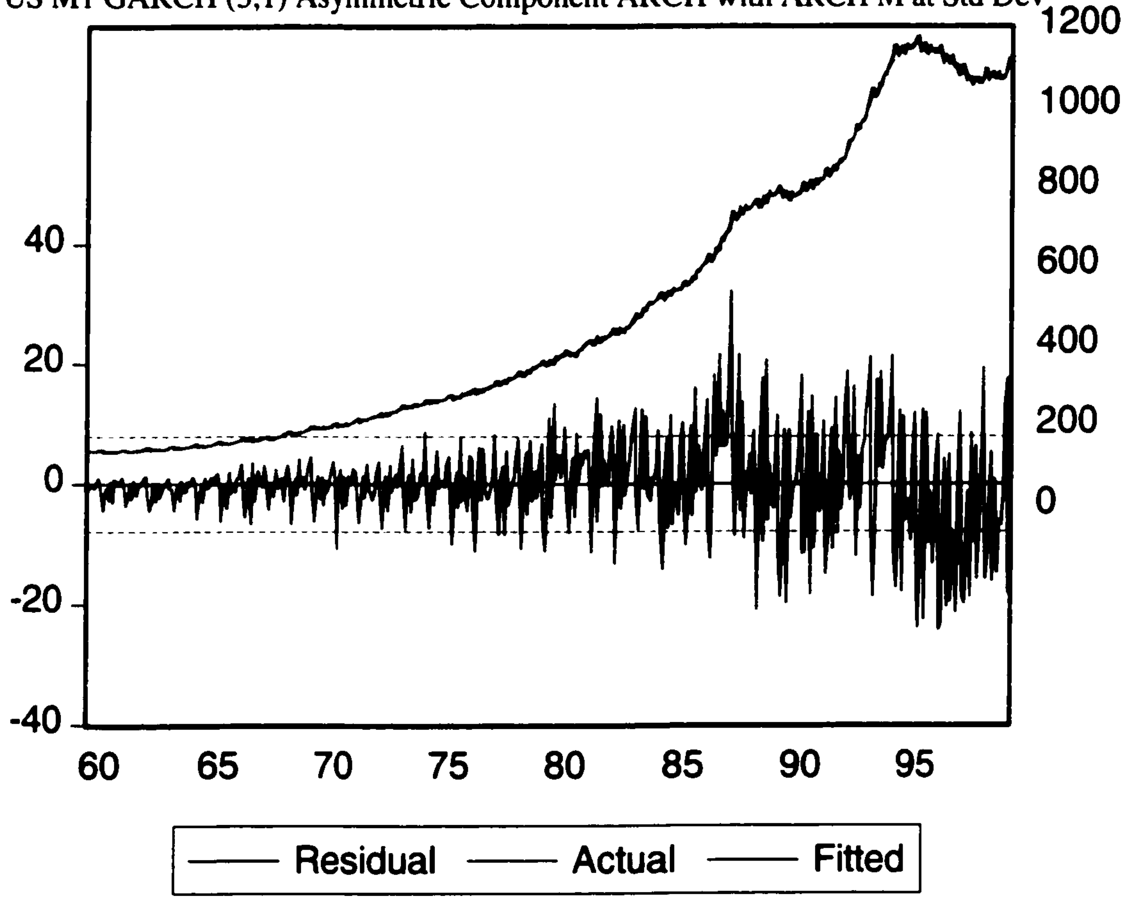
GARCH (3,1) Asymmetric Component ARCH with ARCH M set at Std. Dev.

Dependent Variable: USM1
Method: ML - ARCH (Marquardt)
Date: 09/05/02 Time: 16:09
Sample(adjusted): 1959:06 1999:01
Included observations: 476 after adjusting endpoints
Convergence achieved after 8 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
SQR(GARCH)	-0.977623	0.124595	-7.846400	0.0000
USDEBT	0.001025	0.000366	2.804094	0.0050
RES_RBK_IBY	-0.798903	0.138336	-5.775087	0.0000
INFLUS(-3)	265.9857	43.31648	6.140521	0.0000
RESIDTSE	-4.992244	7.935608	-0.629094	0.5293
C	2.227732	0.445804	4.997108	0.0000
USM1(-1)	0.966622	0.045986	21.02007	0.0000
USM1(-2)	-0.310486	0.057213	-5.426875	0.0000
USM1(-3)	0.540053	0.076863	7.026149	0.0000
USM1(-4)	-0.195576	0.050144	-3.900330	0.0001
	Variance Equation			
Perm: C	60.66068	77.14076	0.786363	0.4317
Perm: [Q-C]	0.999278	2.22E-103	4.49E+102	0.0000
Perm: [ARCH-GARCH]	0.153373	0.030239	5.072060	0.0000
Tran: [ARCH-Q]	-0.068250	0.072535	-0.940921	0.3467
Tran: (RES<0)*[ARCH-Q]	0.118731	0.092277	1.286687	0.1982
Tran: [GARCH-Q]	-0.067105	0.357722	-0.187591	0.8512
R-squared	0.999468	Mean dependent var		498.0378
Adjusted R-squared	0.999451	S.D. dependent var		342.8301
S.E. of regression	8.035215	Akaike info criterion		6.458908
Sum squared resid	29699.75	Schwarz criterion		6.598922
Log likelihood	-1521.220	F-statistic		57614.83
Durbin-Watson stat	1.985357	Prob(F-statistic)		0.000000

USM1 is directly (positively) correlated to US inflation. If the US rate of inflation goes up 1%, then three months later the US M1 money supply goes up 2.66 billion dollars. Here we find the coefficient for INFLUS changes only 0.063 % from the OLS model, but it becomes even more significant. This GARCH model eliminates any concern about heteroskedasticity. There is no serial correlation as the D-W statistic is 1.9854.

US M1 GARCH (3,1) Asymmetric Component ARCH with ARCH M at Std Dev



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M1 are almost identical, over the forty-year period.

M2: Econometric Model (OLS)

Dependent Variable: USM2
Method: Least Squares
Date: 09/05/02 Time: 15:38
Sample(adjusted): 1959:06 1999:01
Included observations: 476 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	0.001807	0.001109	1.628999	0.1040
INFLUS(-3)	242.0388	119.5837	2.024011	0.0435
PRI_FED	1.367976	0.660860	2.069994	0.0390
USSAVINGS	0.009555	0.002841	3.363139	0.0008
C	2.323798	1.530651	1.518176	0.1296
USM2(-1)	1.078078	0.043744	24.64515	0.0000
USM2(-2)	-0.284868	0.061973	-4.596641	0.0000
USM2(-3)	0.525855	0.062200	8.454251	0.0000
USM2(-4)	-0.331700	0.044819	-7.400909	0.0000

R-squared	0.999927	Mean dependent var	1768.029
Adjusted R-squared	0.999926	S.D. dependent var	1263.839
S.E. of regression	10.90741	Akaike info criterion	7.635488
Sum squared resid	55559.69	Schwarz criterion	7.714245
Log likelihood	-1808.246	F-statistic	797098.7
Durbin-Watson stat	2.095935	Prob(F-statistic)	0.000000

Where:

USM2 is the US M2 money supply measured in Billions of US dollars.

USDEBT is US government debt total (both State and Federal) in billions US dollars

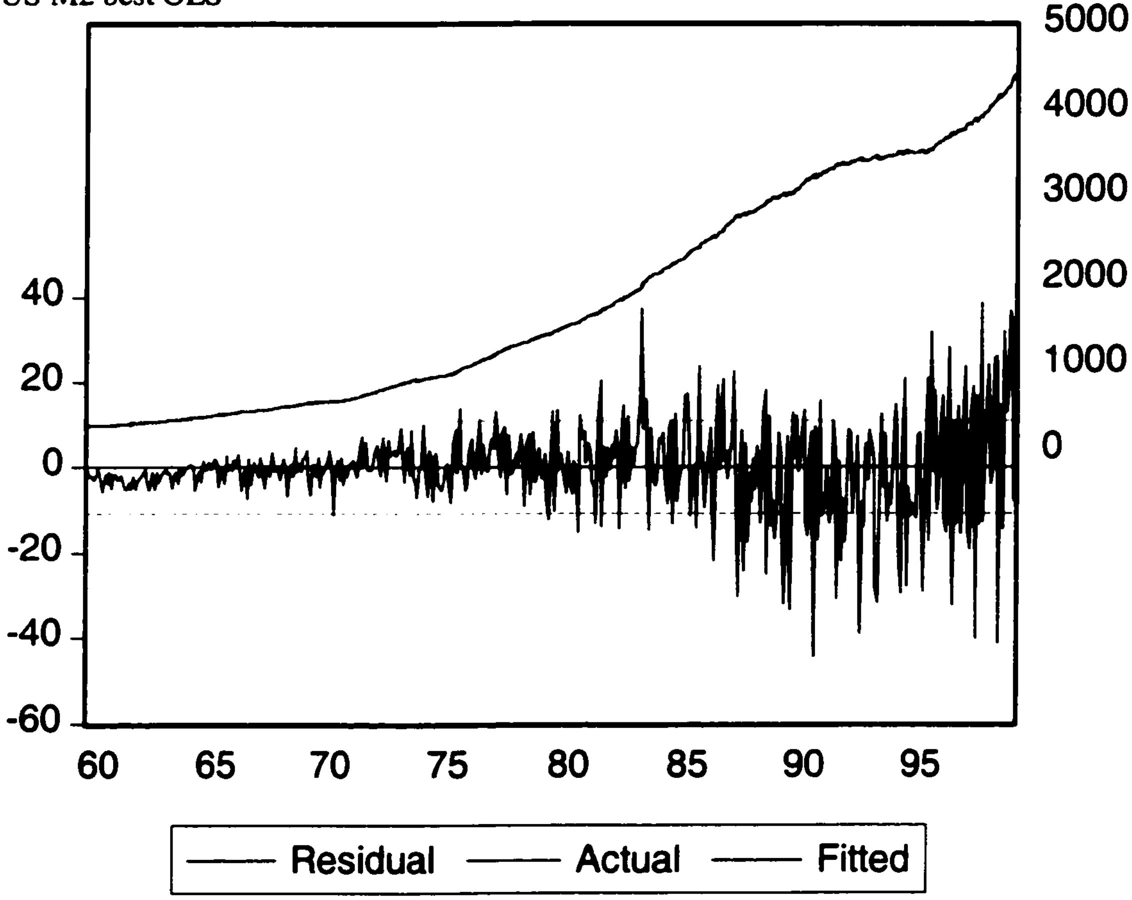
INFLUS is the US rate of inflation in fractional numbers (i.e. 1% = 0.01).

PRI_FED is the US prime rate (in %) minus the federal interest rate (in %).

USSAVINGS is the level of US savings in billions of dollars.

Here we see that USM2 directly (positively) correlated to US inflation. If the US rate of inflation goes up 1% then three months later the US M2 money supply goes up 2.42 billion dollars. There is no serial correlation as confirmed by the Durbin-Watson statistic (2.0959). There was also slight heteroskedasticity, which is not unexpected in time series data with a drift over a forty year period; but the response variable (USM2) and each of the predictor variables are co-integrated and therefore drift together. The following GARCH model allows for heteroskedasticity.

US M2 best OLS



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M2 are almost identical, over the forty-year period.

ML- ARCH (Marquardt) GARCH (3, 1) Model for USM2

GARCH (3,1) with component ARCH and ARCH M set at none

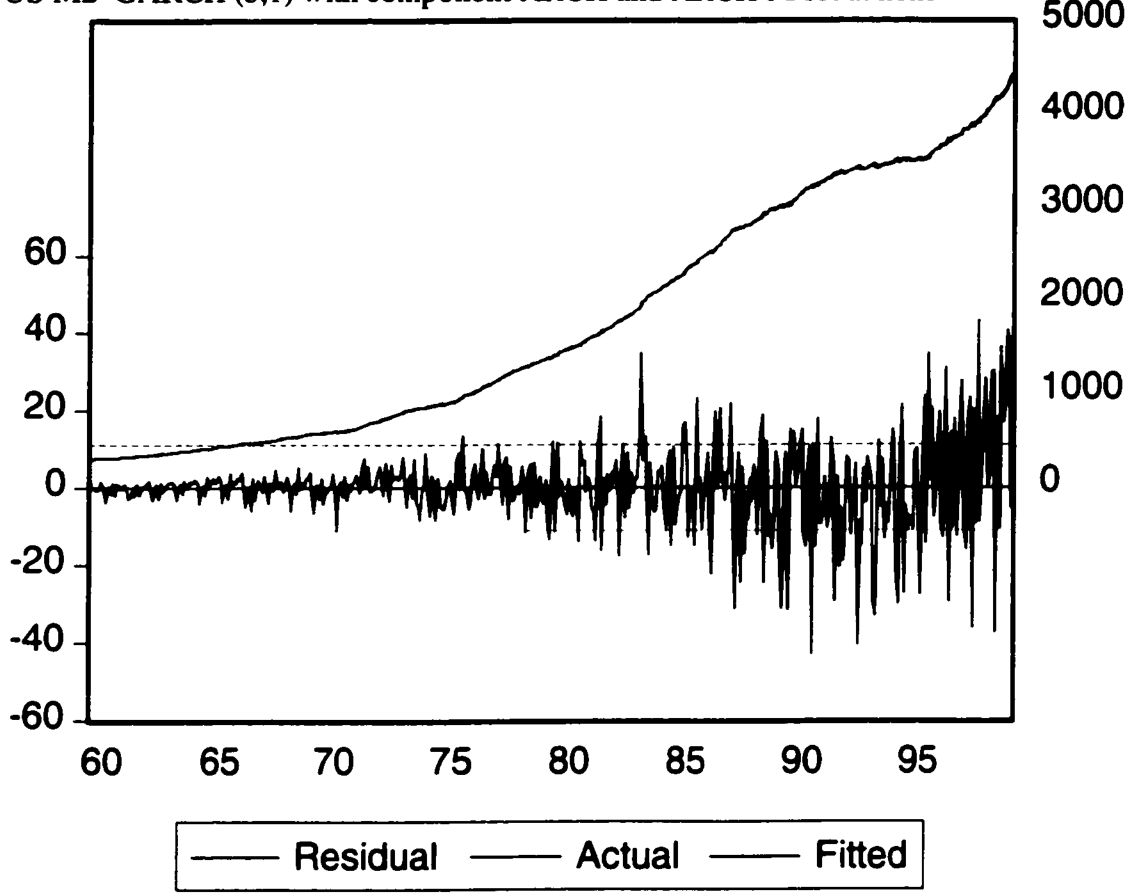
Dependent Variable: USM2
Method: ML - ARCH (Marquardt)
Date: 09/05/02 Time: 15:33
Sample(adjusted): 1959:06 1999:01
Included observations: 476 after adjusting endpoints
Convergence achieved after 18 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
USDEBT	-0.001748	0.000698	-2.504999	0.0122
INFLUS(-3)	173.6685	43.96439	3.950208	0.0001
PRI_FED	0.766330	0.167343	4.579384	0.0000
USSAVINGS	0.003998	0.002207	1.811666	0.0700
C	-0.928443	0.552066	-1.681762	0.0926
USM2(-1)	1.084795	0.032887	32.98521	0.0000
USM2(-2)	-0.274622	0.047571	-5.772912	0.0000
USM2(-3)	0.533913	0.056798	9.400168	0.0000
USM2(-4)	-0.338844	0.040020	-8.466973	0.0000
	Variance Equation			
Perm: C	136.3112	133.2423	1.023032	0.3063
Perm: [Q-C]	0.999832	2.87E-104	3.49E+103	0.0000
Perm: [ARCH-GARCH]	0.044017	0.015087	2.917582	0.0035
Tran: [ARCH-Q]	-0.019888	0.039991	-0.497313	0.6190
Tran: [GARCH-Q]	-0.046425	1.966754	-0.023605	0.9812

R-squared	0.999925	Mean dependent var	1768.029
Adjusted R-squared	0.999923	S.D. dependent var	1263.839
S.E. of regression	11.12136	Akaike info criterion	6.705143
Sum squared resid	57142.33	Schwarz criterion	6.827655
Log likelihood	-1581.824	F-statistic	471829.2
Durbin-Watson stat	2.059800	Prob(F-statistic)	0.000000

USM2 is directly (positively) correlated to US inflation. If the US rate of inflation goes up 1%, then three months later the US M1 money supply goes up 1.73 billion dollars. Here we find the coefficient for INFLUS changes 28.25% from the OLS model, but it becomes even more significant. This GARCH model eliminates any concern about heteroskedasticity. There is no serial correlation as the D-W statistic is 2.0598.

US M2 GARCH (3,1) with component ARCH and ARCH M set at none



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M2 are almost identical, over the forty-year period.

M3: Econometric Model (OLS)

Dependent Variable: USM3
Method: Least Squares
Date: 09/04/02 Time: 16:42
Sample(adjusted): 1959:06 1999:01
Included observations: 476 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F	3.097681	1.078543	2.872097	0.0043
INFLUS(-1)	-286.0371	155.2843	-1.842022	0.0661
INFLUS(-2)	163.7742	159.0848	1.029477	0.3038
INFLUS(-3)	187.1118	158.8121	1.178196	0.2393
INFLUS(-4)	-348.3240	156.1354	-2.230910	0.0262
C	-7.522628	3.294205	-2.283595	0.0228
USM3(-1)	1.360026	0.043358	31.36769	0.0000
USM3(-2)	-0.357471	0.043541	-8.209954	0.0000

R-squared	0.999950	Mean dependent var	2218.715
Adjusted R-squared	0.999950	S.D. dependent var	1687.737
S.E. of regression	11.99110	Akaike info criterion	7.822870
Sum squared resid	67292.08	Schwarz criterion	7.892877
Log likelihood	-1853.843	F-statistic	1344204.
Durbin-Watson stat	1.991144	Prob(F-statistic)	0.000000

The inflation predictor variables (within a 5 % level of significance) for lagged period -4;

= - 348.32

The inflation predictor variables (within a 7 % level of significance) for lagged periods -1 and -4, add up to;

= - 634.36

All four inflation predictor variables add up to – 283.47 (lagged periods -2 and -3 are not significant)

Where:

USM3 is the US M3 money supply measured in Billions of US dollars.

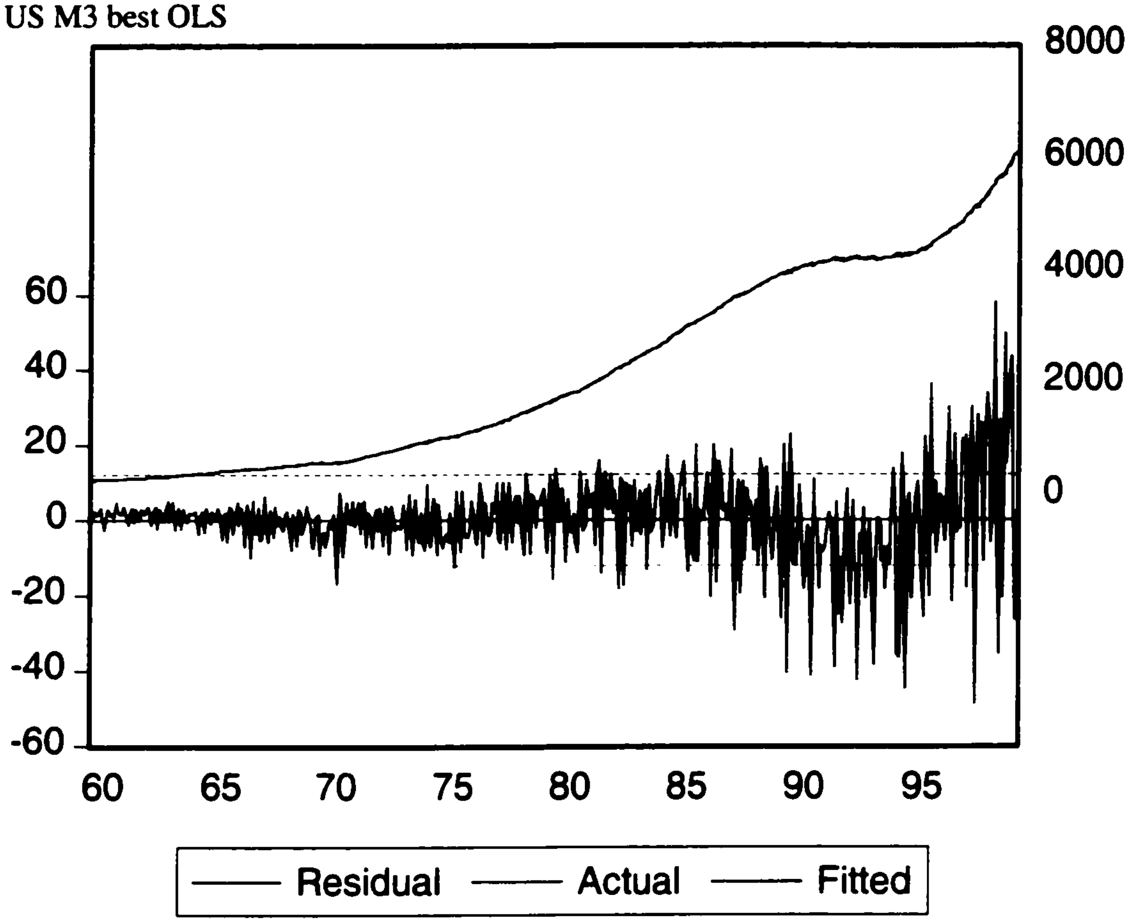
DEBTNF_F is the ratio of non-federal debt to federal debt (US).

INFLUS is the US rate of inflation in fractional numbers (i.e. 1% = 0.01).

Here we see that USM3 is negatively correlated to US inflation. If the US rate of inflation goes up 1%, then four months later the US M3 money supply goes down 3.48 billion dollars (95 % C. L.). Note the M2 component of M3 goes up 2.42 billion dollars with a 1% increase in US inflation rates three months prior. Therefore the large institutional money market accounts (etc.) go down a total of 5.9 billion dollars (over a two month span) with each 1% increase in the rates of inflation, over this forty-year period.

There is no serial correlation as the D-W statistic is 1.9911.

US M3 best OLS



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M3 are almost identical, over the forty-year period.

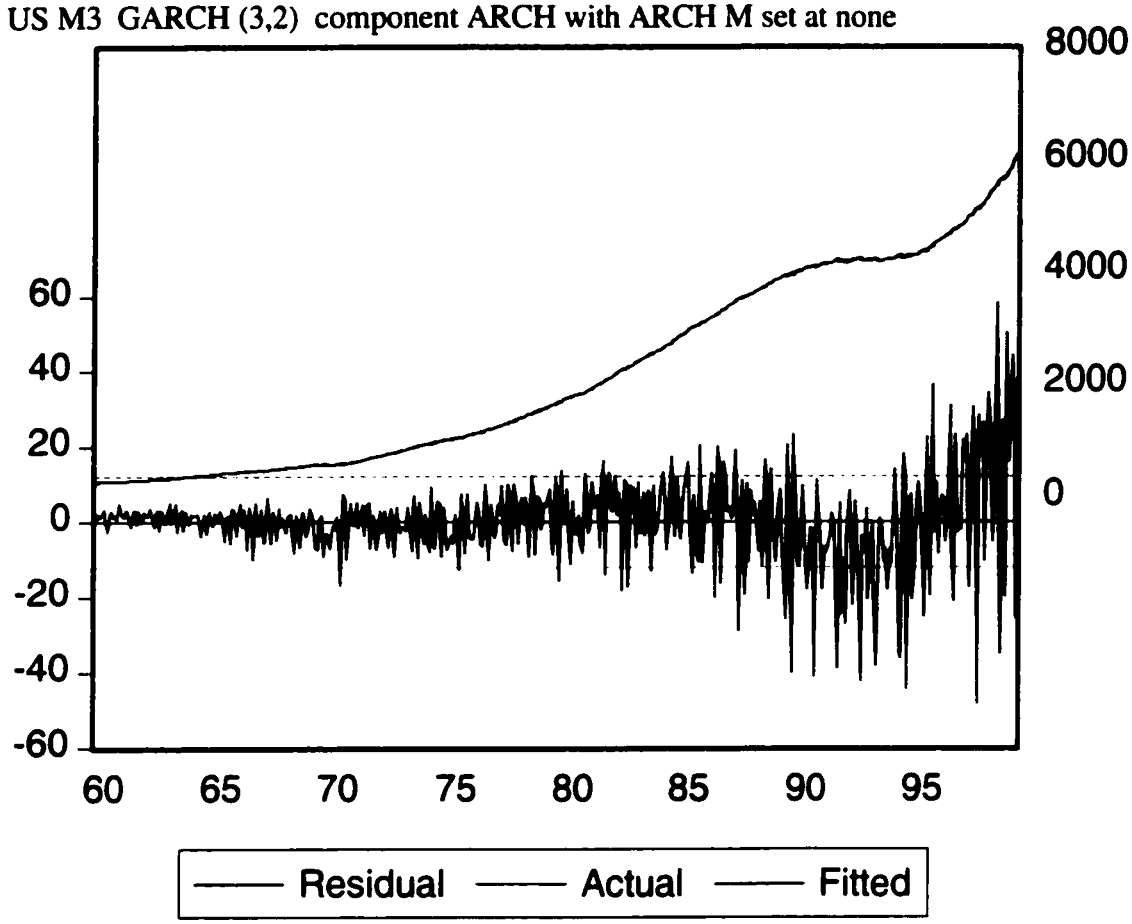
ML- ARCH (Marquardt) GARCH (3, 2) Model for USM3

GARCH (3, 2) ; component ARCH with ARCH M : none
Dependent Variable: USM3
Method: ML - ARCH (Marquardt)
Date: 09/05/02 Time: 15:17
Sample(adjusted): 1959:07 1999:01
Included observations: 475 after adjusting endpoints
Convergence achieved after 5 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
DEBTNF_F	3.198627	0.213736	14.96534	0.0000
INFLUS(-1)	-288.6837	38.85844	-7.429112	0.0000
INFLUS(-2)	159.9950	39.03688	4.098561	0.0000
INFLUS(-3)	184.2045	38.60129	4.771978	0.0000
INFLUS(-4)	-351.3482	37.01854	-9.491142	0.0000
C	-7.633587	0.481279	-15.86105	0.0000
USM3(-1)	1.355950	0.036692	36.95484	0.0000
USM3(-2)	-0.353508	0.036859	-9.590776	0.0000
	Variance Equation			
Perm: C	140.2101	22.62076	6.198292	0.0000
Perm: [Q-C]	1.002441	4.14E-104	2.42E+103	0.0000
Perm: [ARCH-GARCH]	0.181331	0.022786	7.958131	0.0000
Tran: [ARCH-Q]	0.127040	0.039750	3.195986	0.0014
Tran: [GARCH-Q]	0.286619	0.248567	1.153088	0.2489
R-squared	0.999950	Mean dependent var		2210.589
Adjusted R-squared	0.999949	S.D. dependent var		1680.168
S.E. of regression	12.01976	Akaike info criterion		7.262537
Sum squared resid	66747.29	Schwarz criterion		7.376480
Log likelihood	-1711.852	F-statistic		771772.3
Durbin-Watson stat	1.999095	Prob(F-statistic)		0.000000

The four lagged INFLUS predictor variables changed only 4.36% from the OLS regression results, but they became far more significant (all four p-values = 0.0000). Inflation is very much negatively correlated with the M3 levels, with the total of the four inflation point estimators = - 295.8324. Over a four-month period the US M3 level goes down $2.95 billion when inflation rises 1%.

US M3 GARCH (3,2) component ARCH with ARCH M set at none



Above we see that the serpentine plots of the actual values versus the fitted values for the response variable US M3 are almost identical, over the forty-year period.

OLS Checks with ERP as Response Variable;

For each US money measure (M1, M2 and M3) I ran OLS regressions with the Mehra & Prescott theoretical definition of the ERP ($R_{mkt} - R_f$) as the response variable and the money measurements as the only predictor variables. Then I reran these regressions with inflation added as a second predictor variable. The following results were obtained:

M1: $R_{mkt} - R_f = C + M1$ adjusted $R^2 = 0.0069$ Sig. F = 0.0688

USM1; coefficient = 1.02E-05, p-value = 0.06882

$R_{mkt} - R_f = C + M1 + \text{inflation}$ adjusted $R^2 = 0.0289$ Sig. F = 0.00033

USM1; coefficient = -1.5398, p-value = 0.000364

The utility of the regression model improved by a factor of 20 and the adjusted R^2 value improved by a factor of 4 (significant improvement) when inflation was added as the second predictor variable. Very similar results occurred for the M2 and M3 models, indicating that the macro-economic factor inflation is a significant factor in the ERP of the aggregate North American investor.

Part III: Interpretation and Results

A. Positive Results

The econometric models for M1, M2 and M3 support my proposal in the methodology section, specifically; M1 and M2 are positively correlated to the rate of inflation and M3 is negatively correlated to the same, therefore I offer a more accurate definition of the ERP for the North American investor as follows;

$$ERP = R_{mkt} - R_f \text{ - rate of inflation} \qquad \ldots\ldots\ldots\ldots\ldots\ 2.$$

All ERP stated below are annual averages. In the paper 'The Equity Premium (JOF April 2002)' authors' Fama and French use a dividend growth expectations model for the ERP. For the period 1926 to 1999, their calculations show an ERP (dividend growth expectations model) of 6.21 %. This is 30.5% below the theoretical value of the ERP of 8.9% (equation # 1 above) that Mehra and Prescott would have obtained for the same period. The motivation behind the Fama / French dividend growth model was the Gordon (1962) model, and the prime interest was the unconditional expected return estimated simply as the sum of the average dividend yield and the average growth rate of dividends and earnings (Fama, French 2002).

Utilizing my theoretical demand side model of the ERP (equation # 2 above), the ERP is 5.87% for the same period[22], or approximately 5.5% below the value Fama and French obtain with their dividend growth expectations model. The positive theoretical definition (Equation #2 above) of the ERP (dgg), incorporates the macro-economic factor inflation, is supported empirically by the theoretical dividend growth expectations model of Fama and French (2002). Both the Fama, French dividend growth expectations model ERP and my theoretical demand model ERP (equation #2) are significantly closer to the Mehra and Prescott consumption models ERP (< 1 %) than the theoretical ERP accepted and used by Mehra and Prescott (1985) (equation # 1). The value of the ERP obtained from Mehra & Prescott's consumption model is clearly suspect, as is (to a lesser degree) the theoretical ERP they use, as defined by equation # 1 above.

[22] Data for the 1926 to 1999 period was obtained from the Ibbotson data base, specifically series S&P total return (IBOR003450), U.S 30 day T-Bill TR (IBOR003667) and U.S. Inflation (IBOR001103).

Therefore I successfully falsify the theoretical definition of the ERP (Mehra and Prescott (1985) (equation # 1 above). This indicates as per Friend , Blume (1975), the aggregate N. A. investor does not in the aggregate have a logarithmic utility function. A more accurate[23] positive theoretical definition (equation # 2 above) and repeated below, includes the macro-economic factor inflation.

$$ERP = R_{mkt} - R_f \text{ - rate of inflation} \qquad \ldots\ldots\ldots\ldots\ldots \quad 2.$$

Interestingly the above definition for the equity risk premium can be considered a combination of both CAPM and APT asset pricing models (both demand side models). This model includes the ERP as defined by CAPM with an aggregate risk averse investor (logarithmic utility function) but adds a factor risk premium, inflation (a macro-economic factor). The former is CAPM and the latter is APT.

Both CAPM and APT are demand side models that derive equity's expected returns through the payoff demanded by the investors for bearing risky assets. (Ibbotson & Chen, 2002 working paper). My positive theory (equation #2) model is also a demand side model, as it results from empirical evidence of the payoff demanded by N. A. investors for bearing risk (equation # 2 can also be considered an hybrid of CAPM and APT)

The results from this model (equation #2) obtained from data dating from 1926 to 1999 are in close agreement with the results for the same time period, obtained from Fama and French's expectations dividend growth model. The dividend growth model is however a supply side model. Supply side models use fundamental information such as earnings, dividends, or overall economic productivity to measure the expected equity risk premium (ERP) (Ibbotson and Chen 2002 working paper).

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[23] Accuracy is how close your calculated value is to the real world value. Precision is reproducibility and should never be confused with as meaning accuracy.

The empirical agreement of a demand side model with a supply side model is confirmation of both; as each employs a fundamentally different methodology, but both come to the same empirical results and therefore conclusion on the equity risk premium. This can be considered equivalent to QED[2]. I can offer equation # 2 as a positive theoretical definition for the ERP (empirical evidence) as perceived by the North American investor, during the time period 1959 to 1999.. This positive theory (equation #2) is a form of inductive analytical knowledge. For the present and future, this positive definition of the ERP for the North American investor should be accepted, until the falsification of this equation #2 by more recent positive theory, which is counter intuitive.

Part IV: Conclusions and Recommendations:

Inflation is and will continue to be paramount in the minds of the North American investors (in the aggregate) as they determine their equity risk premium. As mentioned earlier, from the paper 'Stochastic Inflation and the Equity Premium' (Pamela Labadie): 'most of inflation's impact on the equity premium results from the inflation tax assessment'. People perceive inflation to be a hidden tax.

People naturally dislike inflation, as they perceive it to be a tax on profits or savings and therefore a risk. When they consider what equity risk premium is necessary in order for them to invest in risky assets, they consider inflation an integral part of systematic risk. According to financial theory (CAPM) the risk premium is compensation for systematic risk and inflation is definitely part of systematic risk. The people in the aggregate realize this and account for inflation in their decision analysis of their own ERP.

Whether the aggregate investor actually believes the government statements on inflation levels or rates; is also factored into the perceived equity risk premium. It is this perceived value, which affects human and therefore investor's behavior.

The empirical results indicate the demand side model (equation No. 2 above) is a more accurate definition of the ERP than the theoretical definition used by Mehra and Prescott (1985) shown above as equation No. 1. The results when applied to the period 1920 to 2000, are supported by the supply side model of Famma and French (2002 JOF).

A. Limitations of Thesis

One limitation of this study is the dependence on the agents of the government for accurate time series data, particularly inflation. The Ibbotson database records monthly inflation values in two decimal fractional formats (i.e. 1% recorded as 0.01). Rounding errors can be as high as 50 %, as the annualized inflation for the month is either 0.01 (1%) or 0.02 (2%) as example. These rounding errors should be independent and random, resulting in a mean reverting trend over time. The time period was forty years should have been sufficient to mitigate this rounding error. This rounding error impacts on shorter time frames of analysis, and would skew the results in decade comparative analysis for example.

B. Further Research

As mentioned previously, further updated research on asset (real versus financial wealth) modeling along with consumption (today versus savings for tomorrow) with the macro economic factor inflation as the predictor variable; would prove valuable. Updating the cross sectional studies and work of Friend and Blume in an effort to falsify or fail to falsify, would be very valuable. The inclusion of inflation (as mentioned by the authors as their first limitation) would be essential.

The effects of taxation on the ERP are also an area of research, specifically the growing demarcation or different taxation levels between the USA and Canada.

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Appendix 1: Unit Root and Co-integration Testing

As mention earlier the only variable in the three models that tested positive for a unit root under all six-test conditions (three each re Augmented Dickey-Fuller and Phillips-Perron Tests) was 'DEBTNF_F' (the ratio of the USA non-federal debt to federal debt). Accordingly I will show these six unit root tests as well as the co-integration test for this predictor variable and it's response variable US M3.

Unit root as |test statistic| < | critical value

ADF Test Statistic	0.653445	1% Critical Value*	-2.5700
		5% Critical Value	-1.9401
		10% Critical Value	-1.6160

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:12
Sample(adjusted): 1959:08 1999:01
Included observations: 474 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	0.000151	0.000231	0.653445	0.5138
D(DEBTNF_F(-1))	0.907114	0.044241	20.50402	0.0000
D(DEBTNF_F(-2))	-0.465560	0.054566	-8.532110	0.0000
D(DEBTNF_F(-3))	0.580146	0.054567	10.63184	0.0000
D(DEBTNF_F(-4))	-0.285121	0.044292	-6.437283	0.0000

R-squared	0.600410	Mean dependent var	0.003228
Adjusted R-squared	0.597002	S.D. dependent var	0.027128
S.E. of regression	0.017221	Akaike info criterion	-5.274839
Sum squared resid	0.139094	Schwarz criterion	-5.230944
Log likelihood	1255.137	Durbin-Watson stat	1.833907

Unit root: tested with an intercept

ADF Test Statistic	-2.175842	1% Critical Value*	-3.4464
		5% Critical Value	-2.8679
		10% Critical Value	-2.5702

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:13
Sample(adjusted): 1959:08 1999:01
Included observations: 474 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	-0.002421	0.001113	-2.175842	0.0301
D(DEBTNF_F(-1))	0.899283	0.044151	20.36840	0.0000
D(DEBTNF_F(-2))	-0.465608	0.054301	-8.574565	0.0000
D(DEBTNF_F(-3))	0.576862	0.054320	10.61968	0.0000
D(DEBTNF_F(-4))	-0.284669	0.044078	-6.458329	0.0000
C	0.009092	0.003848	2.362475	0.0186

R-squared	0.605119	Mean dependent var	0.003228
Adjusted R-squared	0.600900	S.D. dependent var	0.027128
S.E. of regression	0.017138	Akaike info criterion	-5.282475
Sum squared resid	0.137455	Schwarz criterion	-5.229801
Log likelihood	1257.946	F-statistic	143.4336
Durbin-Watson stat	1.835134	Prob(F-statistic)	0.000000

Unit root; tested with trend and intercept

ADF Test Statistic	-1.902874	1% Critical Value*	-3.9816
		5% Critical Value	-3.4212
		10% Critical Value	-3.1330

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:17
Sample(adjusted): 1959:08 1999:01
Included observations: 474 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	-0.002141	0.001125	-1.902874	0.0577
D(DEBTNF_F(-1))	0.895983	0.044133	20.30207	0.0000
D(DEBTNF_F(-2))	-0.469174	0.054264	-8.646066	0.0000
D(DEBTNF_F(-3))	0.575189	0.054246	10.60330	0.0000
D(DEBTNF_F(-4))	-0.290866	0.044187	-6.582684	0.0000
C	0.010480	0.003943	2.657824	0.0081
@TREND(1959:03)	-9.47E-06	6.04E-06	-1.567423	0.1177

R-squared	0.607186	Mean dependent var	0.003228
Adjusted R-squared	0.602139	S.D. dependent var	0.027128
S.E. of regression	0.017111	Akaike info criterion	-5.283502
Sum squared resid	0.136735	Schwarz criterion	-5.222050
Log likelihood	1259.190	F-statistic	120.3095
Durbin-Watson stat	1.835180	Prob(F-statistic)	0.000000

Unit root

PP Test Statistic	0.906479	1% Critical Value*	-2.5699
		5% Critical Value	-1.9401
		10% Critical Value	-1.6160

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 5 (Newey-West suggests: 5)	
Residual variance with no correction	0.000736
Residual variance with correction	0.002614

Phillips-Perron Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:14
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	0.000697	0.000361	1.927971	0.0545

R-squared	-0.007414	Mean dependent var	0.003340
Adjusted R-squared	-0.007414	S.D. dependent var	0.027061
S.E. of regression	0.027161	Akaike info criterion	-4.371958
Sum squared resid	0.351900	Schwarz criterion	-4.363235
Log likelihood	1045.898	Durbin-Watson stat	0.582448

Unit root; with intercept

PP Test Statistic	-2.344697	1% Critical Value*	-3.4463
		5% Critical Value	-2.8679
		10% Critical Value	-2.5701

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 5	(Newey-West suggests: 5)	
Residual variance with no correction		0.000714
Residual variance with correction		0.002492

Phillips-Perron Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:15
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	-0.005713	0.001692	-3.375747	0.0008
C	0.022541	0.005818	3.874187	0.0001

R-squared	0.023381	Mean dependent var	0.003340
Adjusted R-squared	0.021329	S.D. dependent var	0.027061
S.E. of regression	0.026771	Akaike info criterion	-4.398819
Sum squared resid	0.341143	Schwarz criterion	-4.381373
Log likelihood	1053.318	F-statistic	11.39567
Durbin-Watson stat	0.597029	Prob(F-statistic)	0.000796

Unit root; with trend and intercept

PP Test Statistic	-1.895615	1% Critical Value*	-3.9815
		5% Critical Value	-3.4211
		10% Critical Value	-3.1330

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 5	(Newey-West suggests: 5)	
Residual variance with no correction		0.000689
Residual variance with correction		0.002336

Phillips-Perron Test Equation
Dependent Variable: D(DEBTNF_F)
Method: Least Squares
Date: 09/04/02 Time: 22:16
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTNF_F(-1)	-0.004288	0.001700	-2.521958	0.0120
C	0.026543	0.005805	4.572431	0.0000
@TREND(1959:03)	-3.67E-05	8.92E-06	-4.117296	0.0000

R-squared	0.057034	Mean dependent var	0.003340
Adjusted R-squared	0.053064	S.D. dependent var	0.027061
S.E. of regression	0.026333	Akaike info criterion	-4.429702
Sum squared resid	0.329388	Schwarz criterion	-4.403532
Log likelihood	1061.699	F-statistic	14.36485
Durbin-Watson stat	0.619210	Prob(F-statistic)	0.000001

Johansen Co-integration Tests;

Johansen Co-integration Test

Date: 09/04/02 Time: 22:20
Sample: 1959:03 1999:01
Included observations: 474
Series: **USM3 DEBTNF_F**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	1	1	0	0
Max-Eig	1	1	1	1	0
Log Likelihood by Rank (rows) and Model (columns)					
0	-536.7912	-536.7912	-532.8334	-532.8334	-524.2032
1	-527.5580	-525.4536	-522.5583	-522.4961	-521.2363
2	-526.9956	-521.5905	-521.5905	-521.2324	-521.2324
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	2.332452	2.332452	2.324191	2.324191	2.296216*
1	2.310371	2.305711	2.297714	2.301671	2.300575
2	2.324876	2.310508	2.310508	2.317436	2.317436
Schwarz Criteria by Rank (rows) and Model (columns)					
0	2.472915	2.472915	2.482212	2.482212	2.471795*
1	2.485950	2.490069	2.490850	2.503586	2.511269
2	2.535570	2.538760	2.538760	2.563246	2.563246

Johansen Co-integration Test

Date: 09/04/02 Time: 22:22
Sample: 1959:03 1999:01
Included observations: 474
Series: **USM3 INFLUS**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	2	2	2	1	1
Max-Eig	2	2	2	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	167.0512	167.0512	170.6818	170.6818	176.0940
1	178.3912	181.5806	185.1264	191.8430	197.2349
2	185.3610	189.8863	189.8863	197.2355	197.2355
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-0.637347	-0.637347	-0.644227	-0.644227	-0.658625
1	-0.668317	-0.677555	-0.688297	-0.712418	-0.730949*
2	-0.680848	-0.691503	-0.691503	-0.714074	-0.714074
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-0.496884	-0.496884	-0.486207	-0.486207	-0.483046
1	-0.492739	-0.493198	-0.495161	-0.510503	-0.520255*
2	-0.470154	-0.463252	-0.463252	-0.468264	-0.468264

Johansen Co-integration Test

Date: 09/04/02 Time: 21:20
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM1 USDEBT**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	0	0	1	0
Max-Eig	1	1	0	1	0
Log Likelihood by Rank (rows) and Model (columns)					
0	-3294.197	-3294.197	-3290.524	-3290.524	-3278.922
1	-3286.028	-3285.579	-3284.486	-3277.769	-3276.731
2	-3285.221	-3284.486	-3284.486	-3276.476	-3276.476
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	13.93767	13.93767	13.93063	13.93063	13.89020*
1	13.92012	13.92244	13.92205	13.89798	13.89781
2	13.93356	13.93889	13.93889	13.91358	13.91358
Schwarz Criteria by Rank (rows) and Model (columns)					
0	14.07791	14.07791	14.08840	14.08840	14.06549*
1	14.09542	14.10650	14.11487	14.09957	14.10817
2	14.14392	14.16677	14.16677	14.15900	14.15900

Johansen Co-integration Test

Date: 09/04/02 Time: 21:33
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM1 RES_RBK_IBY**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegratin g Relations by Model (columns)					
Trace	2	1	1	1	1
Max-Eig	2	1	1	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	-1953.216	-1953.216	-1941.205	-1941.205	-1937.615
1	-1934.641	-1932.082	-1929.444	-1926.339	-1925.684
2	-1931.790	-1929.060	-1929.060	-1923.858	-1923.858
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	8.291437	8.291437	8.249286	8.249286	8.242589
1	8.230066	8.223503	8.216607	8.207741*	8.209197
2	8.234905	8.231831	8.231831	8.218348	8.218348
Schwarz Criteria by Rank (rows) and Model (columns)					
0	8.431675	8.431675	8.407054	8.407054	8.417887
1	8.405364*	8.407566	8.409434	8.409333	8.419554
2	8.445262	8.459718	8.459718	8.463765	8.463765

Johansen Co-integration Test

Date: 09/04/02 Time: 21:37
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM1 INFLUS**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	2	2	1	1	1
Max-Eig	2	2	1	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	306.9181	306.9181	318.7507	318.7507	322.1737
1	319.8579	321.6941	332.7916	341.5308	344.6419
2	328.5373	334.5284	334.5284	346.4247	346.4247
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-1.224918	-1.224918	-1.266319	-1.266319	-1.272310
1	-1.262559	-1.266081	-1.308596	-1.341182	-1.350071*
2	-1.282262	-1.299067	-1.299067	-1.340735	-1.340735
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-1.084680	-1.084680	-1.108551	-1.108551	-1.097013
1	-1.087262	-1.082018	-1.115769	-1.139590	-1.139714*
2	-1.071905	-1.071180	-1.071180	-1.095319	-1.095319

Johansen Co-integration Test

Date: 09/04/02 Time: 21:38
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM1 RESIDTSE**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	2	2	1	1	1
Max-Eig	2	2	1	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	-488.7994	-488.7994	-476.9754	-476.9754	-473.5054
1	-458.9991	-458.9697	-447.3264	-447.3261	-443.9001
2	-447.1229	-445.5829	-445.5829	-442.0517	-442.0517
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	2.125471	2.125471	2.084107	2.084107	2.077917
1	2.016838	2.020925	1.976111	1.980321	1.970106*
2	1.983675	1.985612	1.985612	1.979165	1.979165
Schwarz Criteria by Rank (rows) and Model (columns)					
0	2.265709	2.265709	2.241875	2.241875	2.253215
1	2.192136	2.204988	2.168938*	2.181913	2.180463
2	2.194032	2.213499	2.213499	2.224581	2.224581

Johansen Co-integration Test

Date: 09/04/02 Time: 21:59
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM2 USDEBT**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	1	1	1	1
Max-Eig	1	1	1	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	-3440.860	-3440.860	-3437.913	-3437.913	-3424.996
1	-3423.312	-3418.761	-3416.470	-3414.552	-3412.084
2	-3422.829	-3416.464	-3416.464	-3411.805	-3411.805
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	14.55520	14.55520	14.55121	14.55121	14.50525
1	14.49816	14.48320	14.47777	14.47390	14.46772*
2	14.51296	14.49459	14.49459	14.48339	14.48339
Schwarz Criteria by Rank (rows) and Model (columns)					
0	14.69544	14.69544	14.70898	14.70898	14.68054
1	14.67345	14.66727*	14.67060	14.67549	14.67808
2	14.72332	14.72247	14.72247	14.72880	14.72880

Johansen Co-integration Test
Date: 09/04/02 Time: 22:00
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM2 INFLUS**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	2	2	2	2	1
Max-Eig	2	2	2	2	1
Log Likelihood by Rank (rows) and Model (columns)					
0	164.7488	164.7488	173.7804	173.7804	183.1162
1	183.0279	183.0688	188.7083	196.0701	205.3724
2	190.9985	195.5436	195.5436	205.9772	205.9772
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-0.626311	-0.626311	-0.655918	-0.655918	-0.686805
1	-0.686433	-0.682395	-0.701930	-0.728716	-0.763673*
2	-0.703152	-0.713868	-0.713868	-0.749378	-0.749378
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-0.486073	-0.486073	-0.498150	-0.498150	-0.511508
1	-0.511136	-0.498333	-0.509103	-0.527124	-0.553316*
2	-0.492795	-0.485981	-0.485981	-0.503961	-0.503961

Johansen Co-integration Test

Date: 09/04/02 Time: 22:02
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM2 PRI_FED**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegratin g Relations by Model (columns)					
Trace	2	2	2	2	1
Max-Eig	2	2	2	2	1
Log Likelihood by Rank (rows) and Model (columns)					
0	-2057.832	-2057.832	-2048.687	-2048.687	-2038.984
1	-2042.406	-2040.626	-2038.577	-2038.334	-2028.838
2	-2035.313	-2031.224	-2031.224	-2028.226	-2028.226
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	8.731926	8.731926	8.701839	8.701839	8.669408
1	8.683814	8.680531	8.676115	8.679300	8.643527*
2	8.670790	8.661998	8.661998	8.657792	8.657792
Schwarz Criteria by Rank (rows) and Model (columns)					
0	8.872164	8.872164	8.859607	8.859607	8.844705*
1	8.859111	8.864593	8.868942	8.880892	8.853884
2	8.881147	8.889884	8.889884	8.903208	8.903208

Johansen Co-integration Test
Date: 09/04/02 Time: 22:03
Sample: 1959:02 1999:01
Included observations: 475
Series: **USM2 USSAVINGS**
Lags interval: 1 to 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	1	1	1	0
Max-Eig	1	1	1	1	0
Log Likelihood by Rank (rows) and Model (columns)					
0	-4065.941	-4065.941	-4055.538	-4055.538	-4041.066
1	-4039.650	-4038.412	-4037.578	-4037.135	-4035.980
2	-4039.031	-4037.263	-4037.263	-4034.787	-4034.787
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	17.18712	17.18712	17.15174	17.15174	17.09922
1	17.09326	17.09226*	17.09296	17.09530	17.09465
2	17.10750	17.10848	17.10848	17.10647	17.10647
Schwarz Criteria by Rank (rows) and Model (columns)					
0	17.32736	17.32736	17.30951	17.30951	17.27452
1	17.26856*	17.27633	17.28579	17.29690	17.30501
2	17.31785	17.33636	17.33636	17.35189	17.35189

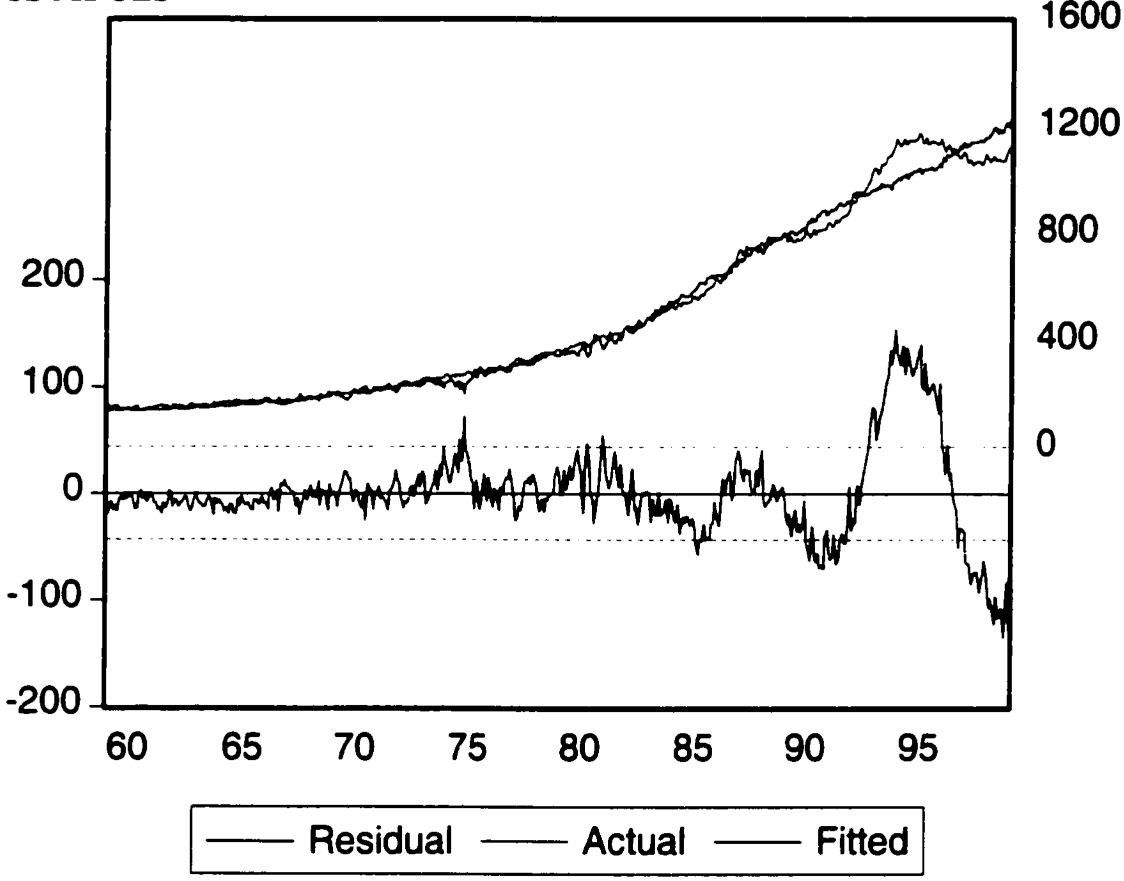
Appendix 2 Original OLS, Tests and GARCH Models;

Dependent Variable: USM1
Method: Least Squares
Date: 08/14/02 Time: 18:52
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	0.069931	0.000446	156.8480	0.0000
RES_RBK_IBY	-9.797273	1.363222	-7.186849	0.0000
INFLUS	1272.290	509.9523	2.494920	0.0129
IBYIELDS	5.250423	0.896270	5.858078	0.0000
RESIDDOW	387.7672	161.9430	2.394467	0.0170
RESIDTSE	236.9972	98.49100	2.406283	0.0165
C	80.20108	6.110617	13.12488	0.0000

R-squared	0.984554	Mean dependent var	494.3125
Adjusted R-squared	0.984359	S.D. dependent var	342.9755
S.E. of regression	42.89441	Akaike info criterion	10.36981
Sum squared resid	872126.8	Schwarz criterion	10.43058
Log likelihood	-2486.938	F-statistic	5035.637
Durbin-Watson stat	0.111292	Prob(F-statistic)	0.000000

US M1 OLS



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95
Residual
Actual
Fitted

Breusch-Godfrey Serial Correlation LM Test: USM1

F-statistic	1994.322	Probability	0.000000
Obs*R-squared	445.8974	Probability	0.000000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/14/02 Time: 19:03
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	-0.000380	0.000121	-3.136665	0.0018
RES_RBK_IBY	0.487285	0.370080	1.316701	0.1886
INFLUS	-812.9674	138.8119	-5.856614	0.0000
IBYIELDS	0.396907	0.243032	1.633145	0.1031
RESIDDOW	-392.7950	44.37943	-8.850835	0.0000
RESIDTSE	-184.7557	26.80065	-6.893702	0.0000
C	0.982041	1.657243	0.592575	0.5537
RESID(-1)	0.693270	0.039311	17.63546	0.0000
RESID(-2)	0.125822	0.047815	2.631426	0.0088
RESID(-3)	0.187911	0.040061	4.690644	0.0000

R-squared	0.927022	Mean dependent var	-3.12E-13
Adjusted R-squared	0.925627	S.D. dependent var	42.62547
S.E. of regression	11.62456	Akaike info criterion	7.764688
Sum squared resid	63646.41	Schwarz criterion	7.851504
Log likelihood	-1857.407	F-statistic	664.7739
Durbin-Watson stat	1.500195	Prob(F-statistic)	0.000000

ARCH Test: USM1

F-statistic	1231.362	Probability	0.000000
Obs*R-squared	423.6412	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 19:03
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.76417	67.66895	1.208297	0.2275
RESID^2(-1)	0.552254	0.045899	12.03195	0.0000
RESID^2(-2)	0.155816	0.054678	2.849675	0.0046
RESID^2(-3)	0.273185	0.047276	5.778487	0.0000

R-squared	0.886279	Mean dependent var	1823.063
Adjusted R-squared	0.885559	S.D. dependent var	3961.340
S.E. of regression	1340.087	Akaike info criterion	17.24719
Sum squared resid	8.51E+08	Schwarz criterion	17.28208
Log likelihood	-4118.078	F-statistic	1231.362
Durbin-Watson stat	1.948958	Prob(F-statistic)	0.000000

White Heteroskedasticity Test: USM1

F-statistic	43.08320	Probability	0.000000
Obs*R-squared	252.4636	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 19:04
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1529.633	1519.872	1.006422	0.3147
USDEBT	-0.449415	0.256515	-1.752001	0.0804
USDEBT^2	6.92E-05	1.60E-05	4.333684	0.0000
RES_RBK_IBY	-194.3818	118.2261	-1.644153	0.1008
RES_RBK_IBY^2	95.88948	33.42542	2.868759	0.0043
INFLUS	-16522.59	151538.9	-0.109032	0.9132
INFLUS^2	2041124.	14086417	0.144900	0.8849
IBYIELDS	-271.2713	460.9512	-0.588503	0.5565
IBYIELDS^2	11.18294	24.53953	0.455711	0.6488
RESIDDOW	4239.044	10666.25	0.397426	0.6912
RESIDDOW^2	497524.0	469712.2	1.059210	0.2901
RESIDTSE	-1056.111	6623.392	-0.159452	0.8734
RESIDTSE^2	256064.8	195428.1	1.310276	0.1907

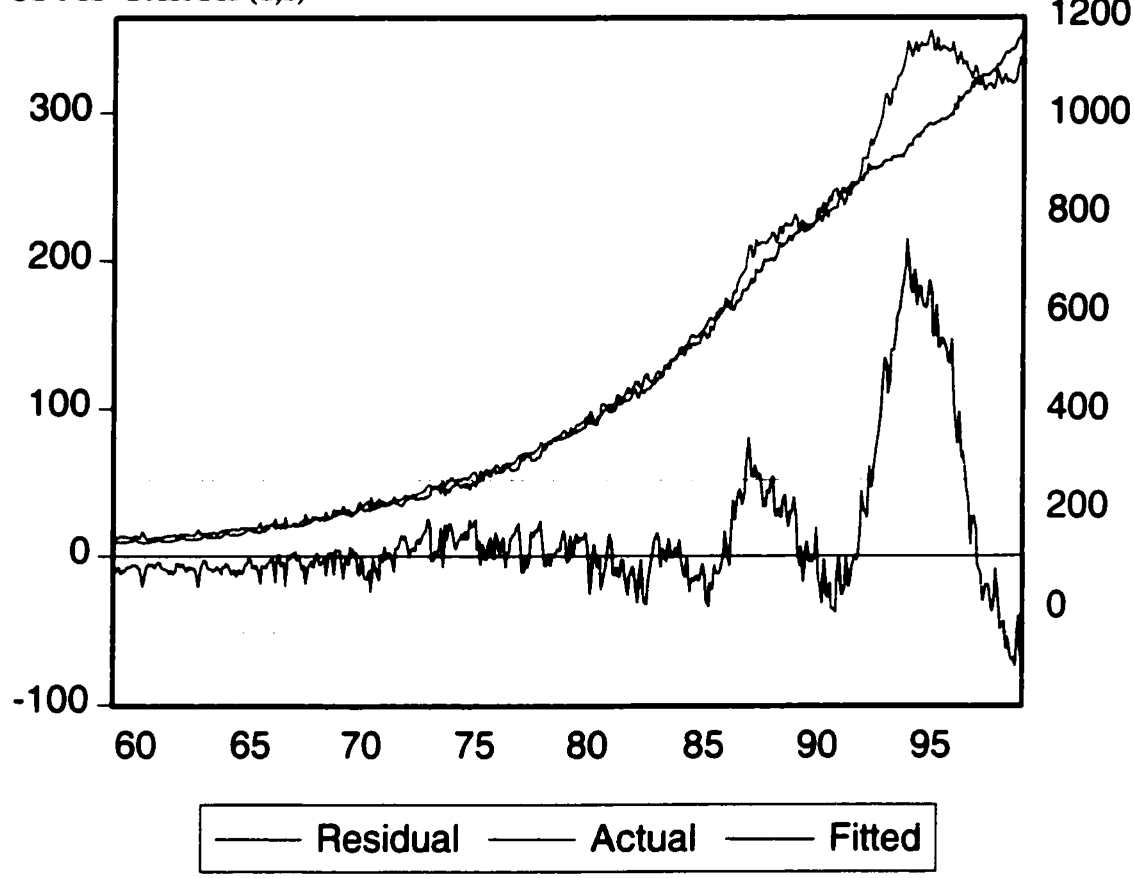
R-squared	0.524872	Mean dependent var	1813.154
Adjusted R-squared	0.512690	S.D. dependent var	3950.935
S.E. of regression	2758.054	Akaike info criterion	18.70909
Sum squared resid	3.56E+09	Schwarz criterion	18.82195
Log likelihood	-4486.537	F-statistic	43.08320
Durbin-Watson stat	0.300227	Prob(F-statistic)	0.000000

Dependent Variable: USM1 GARCH(1,1)
Method: ML - ARCH (Marquardt)
Date: 08/14/02 Time: 19:06
Sample: 1959:01 1999:01
Included observations: 481
Failure to improve Likelihood after 16 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
USDEBT	0.065256	0.000305	213.8898	0.0000
RES_RBK_IBY	-4.639038	0.898730	-5.161771	0.0000
INFLUS	1224.270	170.7631	7.169408	0.0000
IBYIELDS	7.793947	0.604998	12.88259	0.0000
RESIDDOW	117.3799	60.74397	1.932371	0.0533
RESIDTSE	60.92129	55.00422	1.107575	0.2680
C	72.73971	4.395632	16.54818	0.0000
	Variance Equation			
C	560.5970	78.60551	7.131777	0.0000
ARCH(1)	0.914591	0.196327	4.658517	0.0000
GARCH(1)	-0.498589	0.040748	-12.23604	0.0000

R-squared	0.977797	Mean dependent var	494.3125
Adjusted R-squared	0.977373	S.D. dependent var	342.9755
S.E. of regression	51.59114	Akaike info criterion	9.091115
Sum squared resid	1253635.	Schwarz criterion	9.177932
Log likelihood	-2176.413	F-statistic	2304.748
Durbin-Watson stat	0.044324	Prob(F-statistic)	0.000000

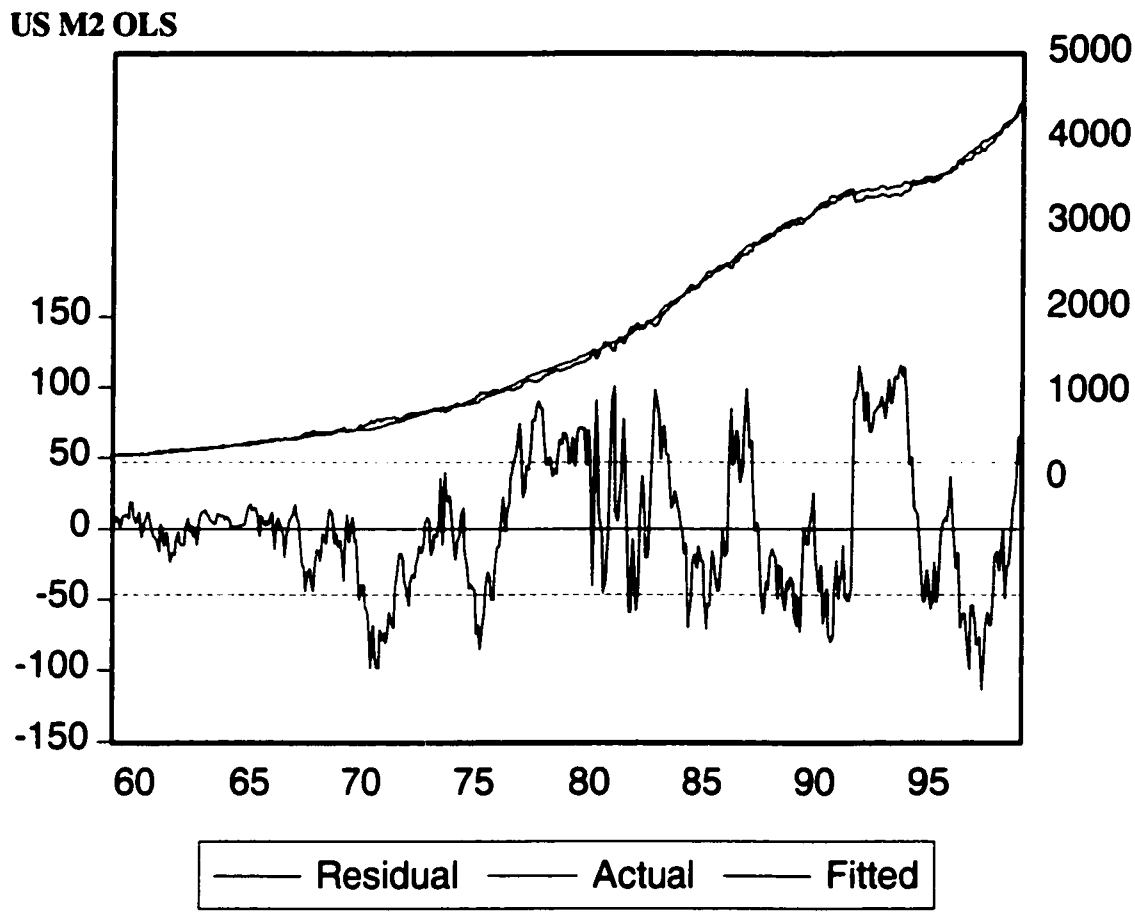
US M1 GARCH (1,1)



Dependent Variable: USM2
Method: Least Squares
Date: 08/14/02 Time: 18:24
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_DBT_S	0.203286	0.001625	125.0653	0.0000
DEBTNF_F	60.48864	4.666286	12.96291	0.0000
INFLUS	1385.272	596.7634	2.321308	0.0207
IBYIELDS	29.15532	1.697782	17.17259	0.0000
RES_RBK_IBY	-22.29817	1.619707	-13.76679	0.0000
PRI_FED	14.91381	3.053506	4.884158	0.0000
USSAVINGS	1.084674	0.002973	364.8781	0.0000
C	-260.8660	13.36863	-19.51329	0.0000

R-squared	0.998650	Mean dependent var	1752.656
Adjusted R-squared	0.998630	S.D. dependent var	1266.173
S.E. of regression	46.86557	Akaike info criterion	10.54894
Sum squared resid	1038889.	Schwarz criterion	10.61839
Log likelihood	-2529.019	F-statistic	49984.44
Durbin-Watson stat	0.183651	Prob(F-statistic)	0.000000


US M2 OLS
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Residual
Actual
Fitted

Breusch-Godfrey Serial Correlation LM Test: USM2

F-statistic	885.7867	Probability	0.000000
Obs*R-squared	408.7122	Probability	0.000000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/14/02 Time: 18:39
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_DBT_S	-0.000280	0.000636	-0.439612	0.6604
DEBTNF_F	4.346332	1.826034	2.380203	0.0177
INFLUS	-1723.841	236.5769	-7.286599	0.0000
IBYIELDS	-0.864500	0.672097	-1.286273	0.1990
RES_RBK_IBY	2.624868	0.644550	4.072405	0.0001
PRI_FED	-2.653259	1.190632	-2.228445	0.0263
USSAVINGS	0.002405	0.001167	2.061056	0.0398
C	-2.784969	5.199930	-0.535578	0.5925
RESID(-1)	0.940426	0.043315	21.71142	0.0000
RESID(-2)	-0.186492	0.059607	-3.128712	0.0019
RESID(-3)	0.196403	0.043586	4.506090	0.0000

R-squared	0.849713	Mean dependent var	-8.19E-13
Adjusted R-squared	0.846516	S.D. dependent var	46.52259
S.E. of regression	18.22618	Akaike info criterion	8.666198
Sum squared resid	156130.9	Schwarz criterion	8.761696
Log likelihood	-2073.221	F-statistic	265.7360
Durbin-Watson stat	1.795141	Prob(F-statistic)	0.000000

ARCH Test: USM2

F-statistic	315.1366	Probability	0.000000
Obs*R-squared	318.3759	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 18:40
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	334.7005	98.70512	3.390913	0.0008
RESID^2(-1)	0.752381	0.045422	16.56429	0.0000
RESID^2(-2)	-0.057010	0.057213	-0.996457	0.3195
RESID^2(-3)	0.153041	0.045538	3.360713	0.0008

R-squared	0.666058	Mean dependent var	2173.047
Adjusted R-squared	0.663945	S.D. dependent var	2874.014
S.E. of regression	1666.074	Akaike info criterion	17.68266
Sum squared resid	1.32E+09	Schwarz criterion	17.71755
Log likelihood	-4222.156	F-statistic	315.1366
Durbin-Watson stat	2.008355	Prob(F-statistic)	0.000000

White Heteroskedasticity Test: USM2

F-statistic	21.60070	Probability	0.000000
Obs*R-squared	189.2989	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 18:40
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7419.670	2806.691	-2.643564	0.0085
RES_DBT_S	0.593346	0.112648	5.267282	0.0000
RES_DBT_S^2	-0.000331	4.44E-05	-7.437886	0.0000
DEBTNF_F	1697.998	1575.328	1.077869	0.2816
DEBTNF_F^2	-354.1042	242.0613	-1.462870	0.1442
INFLUS	-2878.481	127603.2	-0.022558	0.9820
INFLUS^2	1212048.	11898350	0.101867	0.9189
IBYIELDS	1087.959	582.5693	1.867519	0.0625
IBYIELDS^2	-74.63584	28.91680	-2.581055	0.0102
RES_RBK_IBY	-314.0581	115.7483	-2.713285	0.0069
RES_RBK_IBY^2	116.9537	28.06553	4.167167	0.0000
PRI_FED	766.2436	271.9511	2.817579	0.0050
PRI_FED^2	-175.8416	76.51276	-2.298200	0.0220
USSAVINGS	7.485391	1.474565	5.076340	0.0000
USSAVINGS^2	-0.001840	0.000373	-4.930059	0.0000

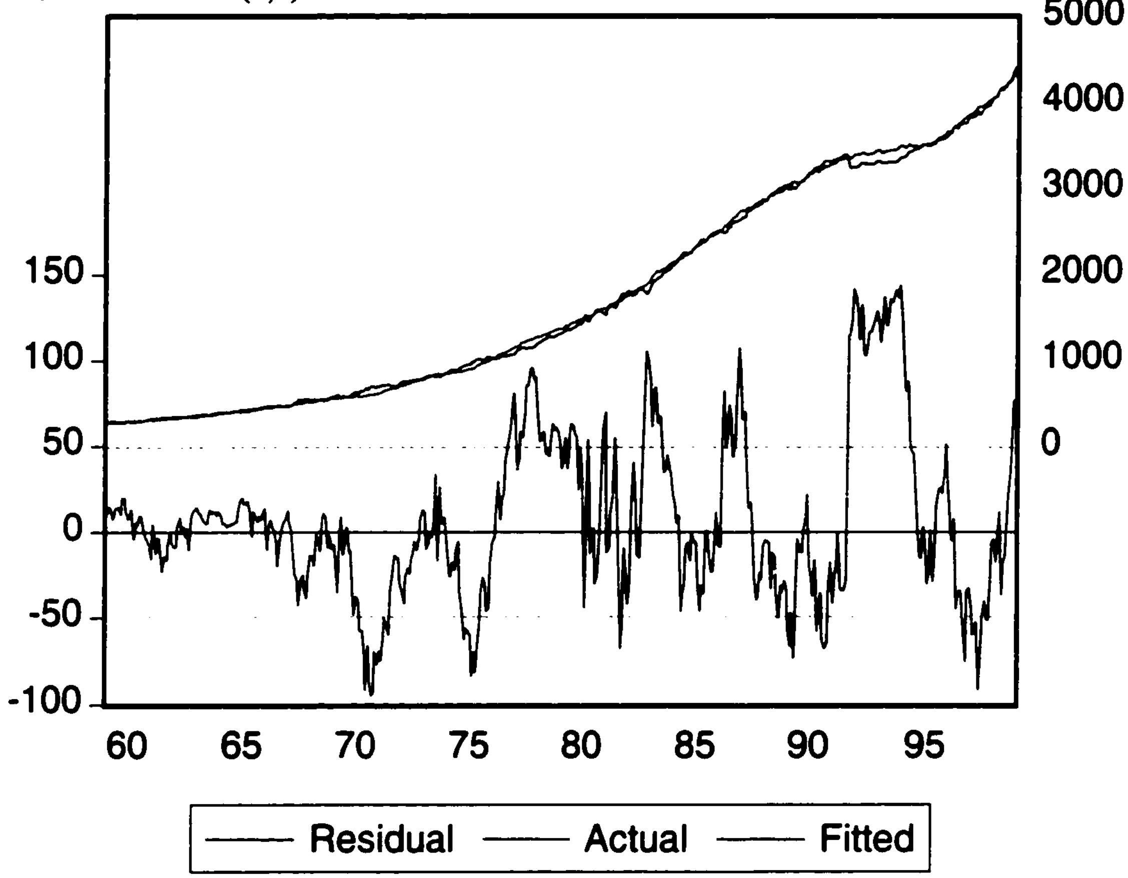
R-squared	0.393553	Mean dependent var	2159.851
Adjusted R-squared	0.375333	S.D. dependent var	2869.867
S.E. of regression	2268.224	Akaike info criterion	18.32207
Sum squared resid	2.40E+09	Schwarz criterion	18.45230
Log likelihood	-4391.458	F-statistic	21.60070
Durbin-Watson stat	0.552585	Prob(F-statistic)	0.000000

Dependent Variable: USM2 GARCH(1,1)
Method: ML - ARCH (Marquardt)
Date: 08/14/02 Time: 18:43
Sample: 1959:01 1999:01
Included observations: 481
Convergence achieved after 6 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
RES_DBT_S	0.199147	0.001648	120.8299	0.0000
DEBTNF_F	62.32922	5.297606	11.76554	0.0000
INFLUS	1384.082	438.1481	3.158937	0.0016
IBYIELDS	27.15618	1.720770	15.78141	0.0000
RES_RBK_IBY	-16.04334	2.85E-100	-5.6E+100	0.0000
PRI_FED	15.53431	2.720531	5.710028	0.0000
USSAVINGS	1.082468	0.002837	381.5964	0.0000
C	-258.1090	16.00840	-16.12335	0.0000
	Variance Equation			
C	1399.451	266.3471	5.254236	0.0000
ARCH(1)	0.759247	0.183333	4.141363	0.0000
GARCH(1)	-0.397049	0.102917	-3.857959	0.0001

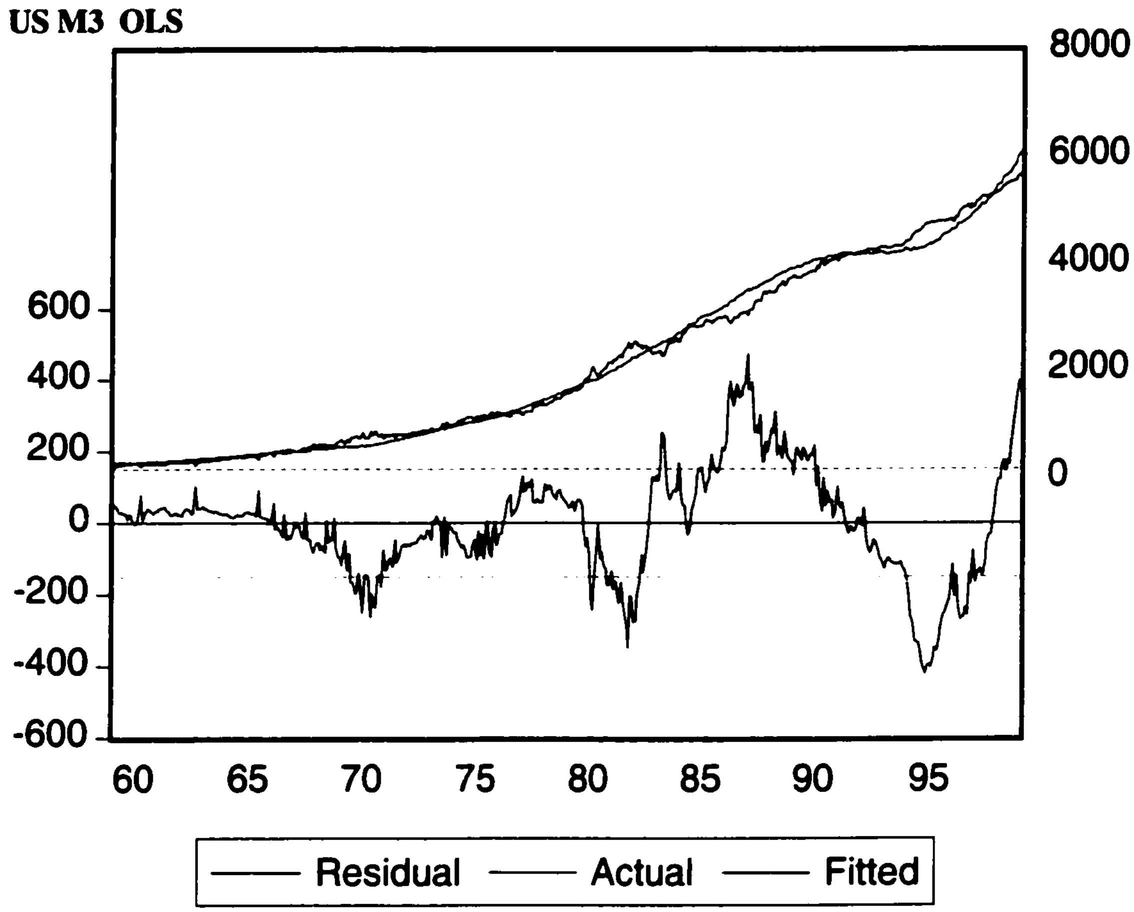
R-squared	0.998520	Mean dependent var	1752.656
Adjusted R-squared	0.998489	S.D. dependent var	1266.173
S.E. of regression	49.22401	Akaike info criterion	10.04516
Sum squared resid	1138812.	Schwarz criterion	10.14065
Log likelihood	-2404.860	F-statistic	31712.48
Durbin-Watson stat	0.143069	Prob(F-statistic)	0.000000

US M2 GARCH (1,1)



Dependent Variable: USM3 OLS
Method: Least Squares
Date: 08/15/02 Time: 19:09
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	0.332058	0.001649	201.3979	0.0000
DEBTNF_F	70.84624	14.26993	4.964723	0.0000
INFLUS	-7045.692	1827.199	-3.856007	0.0001
IBYIELDS	90.80898	4.061307	22.35954	0.0000
C	-453.5234	37.01385	-12.25280	0.0000
R-squared	0.991935	Mean dependent var		2186.656
Adjusted R-squared	0.991867	S.D. dependent var		1683.187
S.E. of regression	151.7974	Akaike info criterion		12.89331
Sum squared resid	10968207	Schwarz criterion		12.93672
Log likelihood	-3095.841	F-statistic		14635.25
Durbin-Watson stat	0.071726	Prob(F-statistic)		0.000000


US M3 OLS
8000
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-200
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-600
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Residual
Actual
Fitted

Breusch-Godfrey Serial Correlation LM Test: USM3

F-statistic	2520.321	Probability	0.000000
Obs*R-squared	452.6811	Probability	0.000000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/14/02 Time: 17:48
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDEBT	0.001125	0.000404	2.786079	0.0055
DEBTNF_F	-8.010586	3.495386	-2.291760	0.0224
INFLUS	3716.300	448.7883	8.280742	0.0000
IBYIELDS	-1.526172	0.996556	-1.531447	0.1263
C	22.82230	9.026146	2.528466	0.0118
RESID(-1)	0.799355	0.043293	18.46403	0.0000
RESID(-2)	0.179104	0.053458	3.350369	0.0009
RESID(-3)	0.010048	0.043334	0.231880	0.8167

R-squared	0.941125	Mean dependent var	-2.41E-12
Adjusted R-squared	0.940254	S.D. dependent var	151.1636
S.E. of regression	36.94902	Akaike info criterion	10.07345
Sum squared resid	645753.8	Schwarz criterion	10.14290
Log likelihood	-2414.664	F-statistic	1080.137
Durbin-Watson stat	1.497839	Prob(F-statistic)	0.000000

ARCH Test: USM3

F-statistic	979.8347	Probability	0.000000
Obs*R-squared	411.6248	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 19:10
Sample(adjusted): 1959:04 1999:01
Included observations: 478 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1439.332	756.7752	1.901928	0.0578
RESID^2(-1)	0.813288	0.045850	17.73792	0.0000
RESID^2(-2)	0.075160	0.059390	1.265530	0.2063
RESID^2(-3)	0.063519	0.046583	1.363561	0.1734

R-squared	0.861140	Mean dependent var	22930.19
Adjusted R-squared	0.860261	S.D. dependent var	37417.19
S.E. of regression	13987.18	Akaike info criterion	21.93800
Sum squared resid	9.27E+10	Schwarz criterion	21.97290
Log likelihood	-5239.183	F-statistic	979.8347
Durbin-Watson stat	1.990047	Prob(F-statistic)	0.000000

White Heteroskedasticity Test: USM3

F-statistic	18.73889	Probability	0.000000
Obs*R-squared	115.9446	Probability	0.000000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 08/14/02 Time: 17:49
Sample: 1959:01 1999:01
Included observations: 481

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15089.83	33344.69	-0.452541	0.6511
USDEBT	7.107378	3.338940	2.128633	0.0338
USDEBT^2	-0.000261	0.000194	-1.344628	0.1794
DEBTNF_F	5584.121	20589.33	0.271214	0.7863
DEBTNF_F^2	-1174.876	3048.266	-0.385424	0.7001
INFLUS	82810.60	1787108.	0.046338	0.9631
INFLUS^2	-22726617	1.67E+08	-0.136019	0.8919
IBYIELDS	1591.299	8535.676	0.186429	0.8522
IBYIELDS^2	-43.93875	425.2060	-0.103335	0.9177

R-squared	0.241049	Mean dependent var	22802.92
Adjusted R-squared	0.228186	S.D. dependent var	37334.74
S.E. of regression	32799.67	Akaike info criterion	23.65276
Sum squared resid	5.08E+11	Schwarz criterion	23.73089
Log likelihood	-5679.488	F-statistic	18.73889
Durbin-Watson stat	0.192520	Prob(F-statistic)	0.000000

Dependent Variable: USM3 GARCH(3,1)
Method: ML - ARCH (Marquardt)
Date: 08/14/02 Time: 17:57
Sample: 1959:01 1999:01
Included observations: 481
Convergence achieved after 12 iterations
Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
USDEBT	0.333161	0.001601	208.0448	0.0000
DEBTNF_F	64.16110	6.849259	9.367598	0.0000
INFLUS	-7044.793	930.6424	-7.569817	0.0000
IBYIELDS	92.61412	3.242478	28.56276	0.0000
C	-435.9763	14.51058	-30.04540	0.0000
	Variance Equation			
C	16416.57	3153.611	5.205642	0.0000
ARCH(1)	0.602361	0.157415	3.826573	0.0001
ARCH(2)	0.570377	0.135781	4.200714	0.0000
ARCH(3)	0.022408	0.107771	0.207925	0.8353
GARCH(1)	-1.000040	1.42E-104	-7.0E+103	0.0000

R-squared	0.991843	Mean dependent var	2186.656
Adjusted R-squared	0.991688	S.D. dependent var	1683.187
S.E. of regression	153.4602	Akaike info criterion	12.13240
Sum squared resid	11092067	Schwarz criterion	12.21922
Log likelihood	-2907.842	F-statistic	6363.775
Durbin-Watson stat	0.071746	Prob(F-statistic)	0.000000

US M3 GARCH (3,1)